61

ELEMENTARY SCHOOLS

HOW TO INCREASE THEIR UTILITY

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BEING

SIX LECTURES

DELIVERED TO THE MANAGERS OF
THE LONDON BOARD SCHOOLS IN 1889 AND 1890

WITH A PREFACE BY

WILLIAM BOUSFIELD

CHAIRMAN OF THE COMMITTEE OF REPRESENTATIVE MANAGERS OF THE LONDON BOARD SCHOOLS, AND CHAIRMAN OF THE SPECIAL COMMITTEE OF THE LONDON SCHOOL BOARD ON THE SUBJECTS AND MODES OF INSTRUCTION IN BOARD SCHOOLS

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PREFACE

THE following lectures form a series organized by the Committee of Representative Managers of London Board Schools, and were, by permission of the Board, delivered in the Board Room of the London School Board. They represent, in all cases, the opinions and experience of writers of knowledge and weight on the subjects with which they deal, and it is believed that at the present moment, when public attention is so much directed to the improvement of elementary schools, and many new forms of development of school life are appearing, they will prove valuable, and of interest to a circle of the public and of the teaching profession wider than that to which they were originally addressed.

It is becoming recognized, and not in this country alone, that it is a narrow and short-sighted view of elementary education to hold that it includes only the subjects of reading, writing, and arithmetic, or even, in addition, the filling of the child's memory with facts, however useful they may be. In preparing any instrument for its functions, it is necessary to remember what these

functions are. The English child of the industrial classes, whether a boy or a girl, looks forward to a life of activity of body and mind, and in the majority of cases to hard manual work. The happiness of its life will depend on its being capable of performing its duties easily and without undue strain. A strong and active body, fingers deft and able to perform what the will directs, and eyes taught to observe, to measure distance and size, and to compare colours, all acting under the control of a mind acquainted, to some extent, with the world immediately surrounding and the laws governing it, are essential to success in industrial life, and any system of popular education which disregards them must be defective. The change in modern habits of life in large towns makes both the training at school of the bodily powers and manual teaching, under which term I include instruction of the hand and the eye, much more necessary than was formerly the case. The son of the farmer, of the country labourer with a garden to his cottage, and of the old-fashioned town tradesman who did all his own work, had no lack of opportunities at home for physical exercise and useful employment, and of gradually making himself acquainted with and capable of performing the functions of his future calling. Systematic training of girls in cookery and housewifery was formerly given them by

their mothers at home as a natural and necessary part of their bringing up, but has now unfortunately become most rare in practice amongst the working classes. In fact, the home training of girls is often made almost impossible by the nature of their mothers' employments, which take them away the greater part of the day, and by the unsuitability and poverty of their dwellings. It is impossible to give adequate teaching in even the most simple kinds of cookery where there are no proper appliances or fireplace; and habits of order, systematic cleanliness, and punctual arrangements for the family wants cannot be learnt in an overcrowded and ill-furnished room. The old English housewifery does not now exist as a domestic art in the labourer's cottage or rooms, and can only be revived by the results of school-teaching being taken there from the outside. It is necessary to create a higher standard of home comfort in the minds of the working classes themselves, and when this is done a larger amount of their increased earnings will be spent on the household *ménage*.

A sense of the want of adequate good result to the children of the training received in popular schools has caused a number of investigations during the past five years, both into present methods of teaching, and the effect of experimental improvements made in England and abroad.

The report of the late Mr. Matthew Arnold into the instruction of popular schools in Germany, Switzerland, and France, as compared with that of the elementary schools in England, brought to public notice at home the fact that our education was less formative of character, and produced fewer permanent results on the children than that of the other countries, where teaching was less purely mental, or addressed to the memory only.

The Royal Commission of Inquiry into the Elementary Education Acts in England and Wales reported in 1888, after making the most minute and exhaustive investigations into all the circumstances and work of elementary schools. Amongst a very large number of recommendations relating to their formation, maintenance, government, and curriculum, the Commissioners laid stress on the necessity of physical training, and of some elementary instruction in science being given as secondary only in importance to the three elementary subjects. They also considered that the curriculum in the ordinary elementary schools might often include not only instruction in the elementary principles of science, but also, in certain standards, elementary manual instruction in the use of tools; and that in higher schools and evening schools this work might be carried still further. Subject to these views, they stated that "reading, writing, arithmetic, needlework for girls, linear drawing for boys,

singing English, so as to give the children an adequate knowledge of their mother-tongue, English history taught by means of reading-books, geography especially of the British empire, and lessons on common objects in the lower standards, leading up to a knowledge of elementary science in the higher standards," ought to be regarded as essential subjects of elementary instruction.

In 1887 the London School Board appointed a special committee to inquire into the subjects and modes of instruction in the Board Schools, and to report whether such changes could be made as should secure that children leaving school should be more fitted to perform the duties and work of life before them. This committee reported to the Board in 1888, after evidence had been taken from teachers and officers of the London and other School Boards, employers of labour, artisans, and others thoroughly acquainted with or engaged in education. They stated that a great change was necessary to make the schools productive of the civilizing and beneficial results of which they were capable; and that while under the present system great attention was secured and thorough discipline, and the teachers had a power of imparting facts with wonderful facility to the children, there was little to awaken the reasoning faculties, and the effect was to make the boys into mere machines. There was nothing in the curriculum that ennobled

labour, and the boys were given an undue bent towards clerkly and non-manual pursuits. The children were not prepared, when they left the elementary school, to profit by the training given in secondary or technical schools, and were often discouraged from taking the first steps in an industrial career. Moreover, parents, considering that the instruction given to their children did not lead to their industrial or pecuniary advancement, were tempted to remove them from school as soon as possible.

The report recommended the further development in the senior schools of the principles of the Kindergarten or Froebelian method in use in infant schools, under which it was attempted to educate and develop all the powers and the physical strength of the child, and not those of the intellect and memory only. It was also recommended that this development should be so arranged as to supply a graduated course of manual training in connection with science-teaching and object-lessons, and that the teaching of all subjects should be accompanied, where possible, by experiments and ocular demonstration. Further recommendations, amongst many others, were also made by the report—that drawing, as the necessary preliminary of industrial training, should be made obligatory on all scholars, with special relation in the case of boys to increased attention to mechanics, geometry,

and measurements to scale; and that the elementary school teaching should be directed to prepare the way for subsequent technical or advanced instruction in continuation and evening schools. Suggestions were also made that the teaching of cookery should be extended to all girls of eleven years of age, and that experimental instruction should be encouraged in the Swedish educational woodwork, called "Slöjd," modelling in clay, and laundry-work, but that no trade should be taught in the schools. In order to allow time for the improved methods of teaching and for manual work, it was recommended that the time now given to spelling, parsing, and grammar generally, should be reduced. With a view of increasing the bodily powers of the children, it was strongly urged that the playgrounds attached to schools should be used for the formation of clubs for hardy sports, gymnastic exercises, and drill, and that the school organizations should be used for the establishment of field-clubs and swimming-classes, and of organized physical education out of school-hours, towards which the personal help of the local managers of the Board Schools was asked. The committee considered that more freedom should be given by the Code and regulations of the Education Department to managers and teachers in the choice of subjects, and in the classification of scholars. The London School Board approved

the recommendations of its committee, and the lectures forming this volume throw light on the gradual progress of making them operative for the benefit of the children.

In addition to the light thrown upon the methods and results of our English elementary education, some very interesting experience has recently come to us from the United States of America. In 1887 an important Commission of Inquiry into Industrial Education was appointed by the legislature of the State of Pennsylvania, and most careful investigations were made by the members of the Commission, of whom Dr. George W. Atherton, the President of the Pennsylvania State College, was chairman, in the various States of the Union, in the United Kingdom, and in the principal continental countries. Their report, presented to the State legislature in 1889, defines industrial education as "education with reference to practical life; the training of the whole child in such a way that his inward powers may act effectively through fit instruments upon his external surroundings, and receive from them in turn accurate and informing impressions"—a definition which expresses the true aim of the popular or elementary school. It is pointed out how valuable to American character has been the effect of their "public" schools, the counterparts of our elementary schools, but that changed circumstances necessitate some alteration

in the methods there employed. The Commissioners say, "The widespread introduction of scientific knowledge and scientific methods into all the industrial processes of the day makes it necessary that the great mass of our children, who leave school at the age of fourteen or sixteen, and under, if they are not to be launched into an unknown world, must acquire such training in the public school as will give them at least some elementary knowledge of the facts and forces with which they will be brought face to face as soon as the doors of the school-house close behind them." Though for the last twenty years the best public schools have "been moving in this direction, it is still true to a far greater extent than it ought to be that their tendency is to educate boys and girls away from the ideas of practical, self-helpful, industrial life, rather than towards it." The Commissioners considered that "until within a very few years the same observations would have been equally applicable to every other country which maintains a system of general education," but that, the defect having been felt, a remedy had been everywhere sought in technical education. "It was, however, remarkable that, by an inversion of what would seem the natural and logical sides, the beginning had in all cases been made at the top rather than the bottom of the system," though "in Sweden, Finland, Switzerland, and France,

scientific and technical instruction was already widespread amongst the masses of the people."

In America experiments have been made in manual work, and instruction in the use of tools, with excellent results. The Commissioners say, "It is surprising to see the readiness with which children, even as young as seven or eight years, enter into the spirit of this training, and find delight in the exercise of the constructive faculty, which almost everywhere manifests itself when the opportunity is given." "The manual training schools in the United States introduce into their curriculum the same educational studies as are found in other schools, and aim thus to develop the intellectual faculties as well as the physical. The testimony of experienced observers is absolutely uniform—that boys who receive this double training are in no respect losers in their intellectual studies by the time spent in the workshop, but are in many, if not the majority of cases, absolute gainers." Their report includes the following experience from the manual training school of St. Louis: "No attempt is made to cultivate dexterity at the expense of thought. No mere sleight of hand is aimed at, nor is muscular exercise of itself held to be of educational value. An exercise, whether with tools or with books, is valuable only in proportion to the demand it makes upon the mind for intelligent, thoughtful work. In the school-shop the stage of

mechanical habit is never reached. The only habit actually acquired is that of thinking. No blow is struck, no line drawn, no motion regulated, from muscular habit. The quality of every act springs from the conscious will, accompanied by a definite act of judgment. Such limited training cannot, of course, produce a high degree of manual skill." The Commissioners also deal with a social and industrial question which is at least as important in England as in the United States—the choice by the children of their future calling. They say, "The period of school life is for most children the formative period. Their tastes, their aptitudes, their tendencies, then take shape, and determine very largely the direction of their future career. If, during this critical period, they learn to look upon labour not only as honourable, but as the natural concern of men; if, beyond that, their labour is, at every step, connected with a knowledge of the principles underlying it, so that manual employment goes hand in hand with intelligence, the effect upon the child's mental attitude in his outlook towards life cannot fail to be decisive."

We, like the Americans, are an industrial nation, and are keen competitors with them in industry and in the supply of the markets of the world, and we cannot, without surely incurring national loss, allow them to outstrip us in the adequate preparation of operatives for their work.

A principal obstacle to organizing our elementary schools as practical educators is about to be removed by the New Code of the Education Department, which has boldly entered upon a new and enlarged course—has substituted a fixed annual Government grant for the old one, calculated on the percentage of passes in the elementary subjects, and calls for our thanks to its authors, the Vice-President of the Council and the officials of the Department. It has been laid before Parliament since the lectures in this volume were delivered, and if administered by Her Majesty's Inspectors of Schools in the spirit in which it is evidently prepared, ought to a very large extent indeed to remedy the grievances of the teachers, expressed in Mr. Ricks's lecture. It gives effect to most of the suggestions for the alteration of the Code made in the Reports of the Royal Commission and of the Special Committee of the London School Board on subjects and modes of instruction, and though it will probably be further improved in future years, gives to school managers and teachers powers which, if used by them as they ought to be to meet the wants of the various localities, must gradually transform the almost purely literary instruction now given in elementary schools into a training of a much more practical kind both for boys and girls.

The New Code, besides relaxing the stringency of

individual examination in the elementary subjects, reading, writing, and arithmetic, and removing the obligation to take English, with its grammar and parsing, as the first Class subjects, gives greater freedom of classification of scholars, makes drawing a compulsory subject for boys, and adds manual instruction, laundry-work, book-keeping, and short-hand as subjects which may be included in the curriculum. A new scheme of instruction is also given in the various branches of elementary science as a Class subject, which includes, *inter alia*, mechanics, principles of agriculture, chemistry, and domestic economy for girls, and we may hope to see a considerable increase in the number of schools taking these interesting subjects. It is also provided that drawing, manual instruction, science, suitable physical exercises, military drill for boys, and practical cookery and laundry-work for girls, may be given away from the school premises and by other than the ordinary teachers, so as to allow them to be taught in centres for a number of schools combining together for this purpose. The moral influences of the school on the children will be recognized by a special grant, now given for the first time, for discipline and organization, under which Her Majesty's Inspector must be satisfied that the authorities of a school take reasonable care to bring up the children in habits of punctuality, of good manners and language, of

cleanliness and neatness, and also to impress upon the children the importance of cheerful obedience to duty, of consideration and respect for others, and of honour and truthfulness in word and act. Additional facilities are also given for carrying on general and special education in evening and continuation schools by those who have left the day schools, thus meeting a want greatly felt hitherto.

The framers of the New Code have been much assisted in their work by the experiments in manual and laundry work, made by the City and Guilds of London Technical Institute and the Drapers' Company, in conjunction with the London School Board. By the liberality of the former, the School Board has been enabled to open six centres in various parts of London, where boys from both Board and voluntary schools have received instruction in the use of the tools required in woodwork and simple carpentry. The teaching has been given in connection with drawing, accurate measurements to scale, and instruction on the nature and variety of woods, and the educational results have been very satisfactory. Four centres have also been opened for teaching in laundry-work, where it has been shown that this useful and practical art for girls can be made of real educational value to them. Great interest has been shown by boys and girls in these classes, which in future can be

formed by School Boards and managers as part of the recognized curriculum.

The lectures in the present volume touch the work and influence of the elementary school on all sides.

The primary necessity of our children having a physical frame and strength fitted to encounter the work of life, without which possessions education is almost useless, is dealt with by Colonel Onslow, who has done much for the improvement of the physique of soldiers in the British army. His complaint that physical exercises for elementary schools are limited by law to military drill, is removed by the Code of this year, but it is most desirable that this branch of education should in future years be recognized by a special Government grant. Much can be done for the children's bodily development by Swedish and similar exercises, but the schools will never do their full work until they are made the centres of voluntary organizations for play and recreation out of school-hours.

The formation of school cadet corps of boys under discipline, combined with arrangements for cricket, football, and swimming, is a subject well worthy of the attention of managers. It is not less important that girls, the mothers of our future people, should in the critical years of childish growth be strengthened by every method possible

in an elementary school. The present teaching of Swedish drill in the London Board Schools for girls and infants is admirable.

Mr. Ricks's lecture is at the present time of great interest to those anxious to know the methods being adopted to promote the continuity of education from the lowest class in infant schools to the upper standards in senior schools, by means of the development of the Kindergarten, with its manual combined with intellectual training. The principles of this system are admitted to be true of all elementary education, but, in their application to older children for the first time in England, the skill of educationists like Mr. Ricks, intimately acquainted as he is with the details of popular schools both as a teacher and inspector, is specially valuable.

The lectures of Mr. Lant Carpenter and of Mr. Grieve adequately deal with the necessity and the practical means of making science-teaching useful and interesting to elementary school children. The London School Board has been, by means of its peripatetic instructors, for some years teaching mechanics as a branch of science in its schools with success; but this important industrial element in education cannot be spread as widely as it ought until the ordinary teachers of the schools have also made themselves competent to teach their boys not only the lessons of text-books, but to make the models and perform the

experiments necessary to give them a real hold on the subjects taught them.

Mr. Lant Carpenter's experience of Board Schools as an active manager enables him to judge accurately what it is practicable to teach boys of school age, and how the teaching may be best adapted to the circumstances of the school. By a graduated scheme of object-lessons from the lowest standards upwards, it is possible, without overpressure or strain, to give children just ideas of the laws of nature surrounding them, and thus to lead up to definite science-teaching.

The only form of music ordinarily taught in an elementary school is singing, and by inquiries made in 1887 this was by far the most popular subject of instruction in the London Board Schools, being preferred by two hundred and sixty-six out of seven hundred and forty-nine boys' and girls' schools; while the next popular subject was reading, which was preferred by one hundred and twenty schools. The high authority of Professor Villiers Stanford gives his opinion great weight on the nature of the music to be taught in the schools. We ought undoubtedly to encourage the development of the English, Scotch, and Irish music that we have, with a view of gradually making a national body of music, growing into the life of the people, and expressing their joys, sorrows, and aspirations. In this work no agency

can be as powerful as the elementary school. Dr. Stanford's appeal for the reservation of the singing grants to singing by notes only would, though not sanctioned by the Royal Commissioners on the ground that many schools would not take singing at all, if no grant were made for singing by ear, greatly tend to improve the character of singing in schools throughout the country. At present note-singing is almost universal in the London Board Schools for older children.

The deepening of the influences of the school on the children by means of healthy recreation, provided by school managers and other volunteers after school-hours, is described by Miss Ada Heather-Bigg, who has herself already done much to spread the good work she advocates. A school is an organism which has a life and growth of its own. If encouraged and cultured by the sympathy and aid of those amongst whom it is placed, it will bear good fruit of many kinds, but all of them leading to the happiness of the children, and through them to that of the community at large.

Ours is an age of social aims and enterprises. We all feel the need of making our complex civilization benefit every class as well as that of the well-to-do, who now enjoy its principal advantages. From the result of baffled hopes in the past, it may be learnt that political change does not itself bring happiness and elevation to the multitude.

The social raising of the industrial classes and the steps for accomplishing it are proceeding equally and *pari passu* in all the most civilized countries of the world, whatever may be their form of government. The most potent and far-reaching of all the instruments for social progress that we have at command is that of the popular school, developed on the lines sketched in these lectures.

WILLIAM BOUSFIELD.

CONTENTS

SCIENCE-TEACHING.

By W. LANT CARPENTER, B.A., B.Sc.,

October 25, 1889.

MUSIC.

By CHARLES VILLIERS STANFORD, Mus. Doc.,
PROFESSOR OF MUSIC IN THE UNIVERSITY OF CAMBRIDGE.

November 29, 1889.

PHYSICAL CULTURE AND RECREATION.

By COLONEL G. M. ONSLOW (late 20th Hussars), ASSISTANT ADJUTANT-GENERAL,

December 13, 1889.

HAND-AND-EYE TRAINING.

By GEORGE RICKS, B.Sc., INSPECTOR OF SCHOOLS, SCHOOL BOARD FOR LONDON,

January 21, 1890.

EVENINGS OF AMUSEMENT.

By ADA HEATHER-BIGG,

February 14, 1890.

MECHANICS.

By W. H. GRIEVE, P.S.A.,

SENIOR SCIENCE DEMONSTRATOR OF THE LONDON SCHOOL BOARD, FORMERLY PROFESSOR OF NATURAL PHILOSOPHY ST. EDWARD'S COLLEGE, LIVERPOOL,

February 28, 1890.

SCIENCE-TEACHING

BY

W. LANT CARPENTER, B.A., B.Sc.

SCIENCE-TEACHING

I FEEL that it is a great honour that I should be asked to state my views upon so important a subject as the share which elementary science ought to take in our national education; and, in the remarks which I shall make, I intend to confine myself to the share which it should take in our Board Schools, as it is that with which we specially have to deal. It is obvious that it is capable of far greater extension, but I shall try to confine myself to that; and I shall also have something to say about the methods of teaching science which it is desirable to adopt. Those amongst us who have paid any attention to the subject are quite aware that, to a certain extent, the teaching of science has been on its trial for some time, and that in many respects the results are not perhaps quite what should have been expected and hoped for; and, when I come to that part of my lecture, I shall try to show that it is not the subject which is in fault, but the way in which that subject has

been taught. But I will not say more about that at this moment.

To begin at the beginning, we ought to have some tolerably clear idea of what we mean by education, and what its object should be. Here let me say, by way of introduction, that I shall offer no apology for making a good many quotations in the course of this lecture, as what has been said on many points has been said so tersely and so well, that I would far rather give you the words of some who are masters of the subject than my own feeble words as they come to me at the moment. This definition which I am now about to quote is a definition of the object of education given by a superintendent of public schools in Philadelphia. It is one which commends itself to me strongly, and I hope it will equally commend itself to you. "The supreme end of education is the harmonious development of all the powers of a human being. Whatever ministers to this end is education. Whatever interferes with its accomplishment, no matter how valuable it is, is outside of the elementary school." Some of these other aspects will be dealt with in later lectures by gentlemen thoroughly well qualified to engage your attention upon them.

Now, it happens that at the meeting of the British Association in Newcastle recently—at which I had not the privilege of being present, for I was then several thousand miles away—a

most important report was presented, nominally, on the teaching of chemistry in elementary schools, but really, as the *Times* observed, the report involved the whole question of science-teaching in general. I wish now to direct your attention to one or two portions of that report. I should first say that the committee appointed by the Association had taken a great deal of trouble to obtain evidence, and this evidence was sifted, and certain recommendations were made upon it. "About the middle of the present century two schools of educational authorities were actively engaged in propagating their views. The one school contended that the object of primary education should be to teach those subjects which can be practically applied in after-life, while the other asserted that its main object should be to develop the faculties, and not merely to store the mind with knowledge. Happily, of late years, a fusion of these two theories has taken place, and agreement has very generally been reached on two important points. First, that the main purpose of elementary education should be to train the intelligence. In this sense education is a high word; it is nothing less than the formation of mind. Secondly, it is admitted that before a man can apply science to practice he must be familiar with its methods; his mind must be able habitually to perform those logical processes which accurate

thought demands. We are now fairly unanimous in the opinion that it should be the endeavour of elementary education to develop habits of correct observation and reasoning, so that in later life the more advanced knowledge of science which will subsequently have been acquired may be intelligently applied to the solution of social and industrial problems." I think it may fairly be said that, so far, the public in this country has had very few opportunities of judging of the educational value of physical science, using that term in a somewhat general sense, and including what we ordinarily call mechanics, chemistry, and so forth. Dividing science broadly, as it were, into physical science and biological science (and I desire to be understood as speaking with reference to physical science in that broad sense of the term, rather than of biological science), I think it is rather to be feared that the public has not yet sufficiently recognized the truth and significance of Herbert Spencer's definition of science; the words are these: "trained and organized common sense." Now, another report, and not the particular one from which I have been quoting, was made to another section of the British Association, which points out that, during the last few years, the pursuit of science in elementary schools, as shown by the returns of the education department, has considerably decreased, according to the figures

I have before me, from twenty-nine per cent. to seventeen per cent. There may be, as we shall presently see, a reason for that. And here I should like to refer to the splendid work which was done by a committee which was "to consider the present subjects and modes of instruction in the Board Schools, and to report whether such changes can be made as shall secure that children leaving school shall be more fitted than they now are to perform the duties and work of life before them." Giving you in barest outline what happened, I may tell you that the committee held twenty-two meetings, and took a large body of evidence. They started with such a definition of education as that which I have put before you in almost the same words, and their report points out that "the greater part of the benefits of education are moral benefits, and that fearless truth, bravery, honour, activity, manly skill, temperance, hardihood, welded into a great national character, are objects of national education." But when we come to inquire if the present system does produce such harmonious development of all the children's faculties, bodily and mentally, that they leave school fitted, as far as possible, for the battle of life, there is an almost universal consensus of opinion in the negative on the part of witnesses of all classes. Professor Huxley's utterance at Manchester, in November, 1888, is quoted as a

summary. "Elementary education is too bookish —too little practical. The child is brought too little into contact with actual facts and things, and there is no education of those particular faculties which are of the utmost importance to individual life—the faculty of accurate work, and the faculty of dealing with things instead of words." Then the committee goes on to report certain changes, and it is, I think, a significant fact that of the changes which were recommended more than half related to the teaching of science in some form or other. It points out that the "committee cannot exaggerate the importance of the question with which they deal, for it vitally affects the future of the mass of the London people. Everybody suffers when education goes wrong. The failures are the lives of men. The teacher's workshop is strewed, not with shavings and wasted wood, but with wasted years and broken lives."

Now, I should like it to be distinctly understood that, in advocating the claims of science to a position in education, there is no desire on the part of those who do advocate those claims to displace any of the traditional subjects from the school course; all that is asked for is a fair share of the children's time, attention, and brains—a share proportionate to the effect which such studies can demonstrably produce in developing the mental faculties of the individual; that, in fact, natural

science claims to co-operate, and in no sense sets itself up as a rival. It is sometimes said, "Oh, there is no time in the present curriculum for the teaching of science;" that, in fact, is the first objection that is usually made when it is proposed to introduce science-teaching into a school. "There is no time." What does that argument really amount to? It means that in the time at disposal other things are considered of more importance; and what I am pleading for now is that science should have a fair share in the appropriation of time, and that it should be considered sufficiently important to take its place *pari passu* with the literary portion of teaching. Although it may sound somewhat paradoxical, I assure you that the result which has been obtained in many towns has been that although less time may have been devoted to the ordinary work of the school—the ordinary instruction in reading, writing, and arithmetic, and so on,—although time, perhaps two or three hours a week only—may have been taken away from that and devoted to elementary science-teaching, given in the right way, it has been found that the general intelligence of the children has been so quickened that they do better in their ordinary work, although they give less time to it. I cannot, of course, in the short time at my disposal, quote statistics, and give you chapter and verse, but I must ask you to believe,

on my word, that there is an immense body of evidence to prove the accuracy of my statement.

Again, let us take the question of variety. You may draw an analogy from the physical nature of a child. A child would starve, practically, if he were fed exclusively on meat, or exclusively on bread, or exclusively on any one food or class of food, and his health could not be good; but give the child variety in its physical food, and its health at once becomes good. And the same argument equally applies to the mental food which should be given. I should like to say that the first great experiment in the introduction of elementary science-teaching into Board Schools was made some years ago by the Liverpool School Board. They devised a special system of teaching science—as to which I may say a few words presently—after consultation with some of the most eminent science-teachers of the day—Professor Huxley amongst others—and it was in Liverpool that the result of which I have spoken was first clearly worked out. In two or three years from the time of the first introduction of this special science-teaching they raised the percentage of passes, obviously owing to the increase of general intelligence.

Now, the aim of science-teaching properly conducted—the kind which I am advocating, at any rate—ought to be to put the pupils into an intelligent relationship with the phenomena of the

world in which they live. Perhaps there are few who have any real conception—I say few, at any rate, of those who have not actually to teach—of the extraordinary ignorance of average children with regard to the everyday phenomena going on around them. Some few years ago a very remarkable test was made on the children attending a large school. The children were carefully questioned singly, and in such a way that no child heard the answers given by the others, and the results were tabulated. I will give you one or two of those results, for they are almost incredible. Fifty-five per cent. of the children did not know that all things made of wood came from trees; and, mind you, it is not so many years ago that this happened. Sixty-nine were ignorant of the origin of woollen things. Seventy-five and a half per cent. did not know what season it was. I cannot resist just mentioning one other curious incident of a child in the higher school in Kensington. The child had seen some leather being nailed over boxes with brass-headed nails, and, looking up at the starlit sky one night, asked its mother, "Are those the nails which keep heaven up?" I think some of us have heard the story of the Eton boy, who, when asked how it was the days were longer in summer than in winter, replied, "Heat expands all bodies, and in summer it is warmer than in winter."

Now, with regard to this relationship of the child to the phenomena going on around it, I should like to quote to you a description of our debt to science, given by Archdeacon Farrar in his address at Liverpool, which is equally applicable to London. "In this great commercial city," he said, "where you are surrounded by the triumphs of science and of mechanism—you, whose river is ploughed by the great steamships whose white wake has been called the fittest avenue to the palace front of a mercantile people—you know well that in the achievements of science there is not only beauty and wonder, but also beneficence and power. It is not only that she has revealed to us infinite space crowded with unnumbered worlds, infinite time peopled by unnumbered existences, infinite organisms hitherto invisible but full of delicate and iridescent loveliness; but also that she has been, as a great archangel of mercy, devoting herself to the service of man. She has laboured, her votaries have laboured, not to increase the power of despots or add to the magnificence of courts, but to extend human happiness, to economize human effort, to extinguish human pain. Where of old men toiled, half blinded and half naked, in the mouth of the glowing furnace to mix the white-hot iron, she now substitutes the mechanical action of the viewless air. She has enlisted the sunbeam in our service to limn for us,

with absolute fidelity, the faces of the friends we love. She has shown the poor miner how he may work in safety amid the explosive fire-damp of the mine. She has, by her anæsthetics, enabled the sufferer to be hushed and unconscious while the delicate hand of some skilled operator cuts a fragment from the nervous circle of the unquivering eye. She points not to pyramids built during weary centuries by the sweat of miserable nations, but to the lighthouse and to the steamship, to the railroad and telegraph. She has restored eyes to the blind and hearing to the deaf. She has lengthened life, she has minimized danger, she has controlled madness, she has trampled on disease. And on all these grounds I think that none of our sons should grow up wholly ignorant of studies which at once train the reason and fire the imagination, which fashion as well as forge, which can feed as well as fill the mind." In passing, I should like to mention one or two books the avowed purpose of which is to try and put young persons into an intelligent relationship with the phenomena around them. One of them is written by Professor Guthrie, of South Kensington, and is called "The First Book of Knowledge;" and the other is a most valuable little book by M. Paul Bert, "The First Year of Scientific Knowledge." Tens of thousands of copies of that book have been circulated all over France, and there is now

an excellent English version of it published, and I would earnestly recommend it to your attention. Although as I shall tell you presently, science is not to be taught simply by reading books, at the same time, such works as those I have just referred to form excellent guides in the hands of a properly trained teacher.

I would ask now what is the position of science in our elementary schools? We all know that there are certain classes, or optional subjects, such as elementary science, chemistry, and some other subjects approved by the Council, but I want to call your special attention to what is meant by "optional." The subjects called optional are not really so in the sense that the classes are there, and that it is at the option of the parent whether his child shall attend them or not — not at all; they are there or are not there at the option of the school managers, of the school teachers, at the suggestion of the Board Inspectors, or of the Board School Committee, or the London School Board itself. The point which I wish to drive home to you is that this option is not the option of the child, or of the child's parents, but is a sort of council option; and, as most of us know very well, a child may go through the whole course—through all the seven standards of the elementary school—and yet know practically nothing about such subjects as those to which I have been allud-

ing. And here I will venture to make a quotation from a speech of the late Professor Guthrie, to whom I alluded just now. He says, "A child may pass some years in the infant school, and then pass through all the seven standards of the school proper, and yet know nothing beyond reading, writing, and figuring, except the little knowledge he may have got from the object-lessons of the infant school, and the history contained in his reading-lessons. Think what this means! He may know that William of Normandy stumbled on landing in England; he has probably never seen a triangle. He may know how many furlongs there are in a mile; he is generally under the impression that his indrawn breath goes into his stomach, which is somewhere below his waist, and so on. In reading, writing, and arithmetic you have given him the keys of knowledge, but you have not even let him peep into its treasures. It is true that not one child in a thousand is capable of becoming a scientific man; that is no reason whatever why the opportunity of learning the elements of science should not be offered to all. Such opportunities are to be given, not so much for the sake of the thousandth child, nor even for the sake of the good to the community which will accrue from his career, as for the sake of the nine hundred and ninety-nine children who will have at least the chance of obtaining some scientific culture, and so

be in sympathy with those upon whose shoulders rests the task of advancing civilization. Though a boy may not be 'intended' for an occupation in which science is required, and though he show little or no aptitude for it, nevertheless it is as unjust to hide science from him as it would be to hide a knowledge of history or literature from those who are not 'intended' to become historians or authors." I claim, therefore, for science a position on equal terms with literature.

And now we come to the question of how science should be taught. The great object, to my mind, in teaching science is that it should be so taught as to call out the observing and reasoning faculties of the child. A friend of mine, who is himself a teacher, and who has a good deal to do with young fellows who have passed through the ordinary Board School course, and voluntary schools also, made this terse remark to me one day about them: "They can't think, they won't think, and they resent being called upon to think;" that, he said, was his experience of boys and girls who were supposed to be, in one sense of the term, educated—who had gone through the curriculum of the ordinary elementary schools. Let me also quote two or three words from the report of one of the Royal Commissions upon the subject: "Science quickens and cultivates directly the faculty of observation, which in very many persons lies almost dormant

through life, the power of accurate and rapid generalization, and the mental habit of method and arrangement; it accustoms young persons to trace the sequence of cause and effect; it familiarizes them with a kind of reasoning which interests them, and which they can promptly comprehend; and it is perhaps the best corrective for that indolence which is the vice of half-awakened minds, and which shrinks from any exertion that is not, like an effort of memory, merely mechanical."

Now, another plea, although you might say it is to some extent a side issue, for the grounding of the young—boys and girls both—in elementary science, is what one might venture to call, perhaps, the universality of the language of science, and particularly those sciences which are called the exact sciences, although, perhaps, the name "universal science" would be better; such sciences as those I am specially speaking of—mathematics, mechanics, chemistry, and physics. The laws of these hold good, so far as we know, throughout the universe; they are of universal application. Moreover, if you come to inquire into the way in which some of the Eastern nations took up our so-called civilization, you notice almost invariably, whether it be in India, China, or Japan, that they have very little indeed to say to our literature, but they take hold at once of the language and the facts and the laws of science. As Professor Guthrie

says, "The Oriental accepts our science eagerly and gratefully, because it is not more ours than it is American, German, Russian, or his own. To our customs, our sports, our literature, he must always remain a stranger, because at heart indifferent to them. In our telegraphs, railways, works of irrigation, and the sciences which lead to them, he takes a far keener interest; for such sciences, being universal, are in truth as much Oriental and his, as Western and ours." Some of you are probably aware, from your own knowledge, of the extraordinary way in which a knowledge of science has been sought for on the part of the Japanese, and I am in a position to say, having had a good deal to do lately with a gentleman who is a member of the Siamese Legation, that the Siamese are following in the track of the Japanese. Surely, then, if science has a language which applies in such a cosmopolitan fashion, it is not too much to ask that *our* youngsters should have some of the same kind of learning.

Now a few words with regard to the modes of teaching science. One broad principle ought to be laid down at the very outset, and that is that it should not be learnt from books—that the science should be taught; that there should be the living enthusiasm of the teacher imparting the knowledge to his pupils; and, above all, that the pupils themselves should see him handle things, and should,

wherever possible, handle things themselves. Of course, all this means a certain amount of apparatus, but, above all, it means trained teachers—teachers who are thoroughly capable of imparting information of this kind—and, consequently, it needs a certain amount of modification in our school system. You may say, perhaps, if you have a sufficiently large school, there should be no reason why one or two of the teachers there should not be trained teachers of this kind. I have already dealt with the argument of time; therefore, as you do not occupy more time, neither do you necessarily require a greater number of teachers—for it is really the mere question of allotting the subjects. But where the schools are not large enough for that, then one of the best modes of carrying out the proper teaching of science—the teaching of things—the observing and the drawing of deductions from experiments of a simple character, and chosen always with a view to the facts and phenomena which are constantly before children in their daily life,—then I say the best mode of carrying out such teaching is to adopt the system which was first worked out in Liverpool, and was then extended to Birmingham, Leeds, Manchester, and other large towns in England. The introduction in London of the peripatetic system, as it is called, was mainly due to my respected friend Dr. Gladstone, the vice-president of the School Board, and its results

have more than fulfilled the expectations of those who were sanguine about its success. Dr. Gladstone wrote to me the other day in reply to an inquiry I made as to how the system was getting on. At first it was only tried in one district, but now it has been extended to a large number of others. He also sent me a report, from which I gathered that the teachers in the different schools see most clearly the beneficial effects of such teaching; and they ask for it. It has been applied for in increasing instances, and it has been going on sufficieutly long to enable the ordinary staffs in some of the schools to take it up; therefore, in those cases, the peripatetic staff which goes from school to school will be available for other places. The essence of the system is that teachers who are specially trained to give this particular kind of science-teaching are sent from one school to another, giving perhaps two lessons in the morning and two in the afternoon, if the schools are sufficiently near. They carry with them the apparatus which is necessary for the illustrations which they have to give, and as I am so anxious to bring home to you the importance of the children actually seeing the things themselves, I am going to venture to show you one or two experiments, and I have chosen them more particularly with a view of showing you how the optical lantern may be used in the teaching of science, and for a great

number of purposes other than the mere projecting on the screen of photographs.

One of the points I want to bring before you is that it is quite possible to use the lantern for the purposes of teaching in a room which is only half dark. One of the objections to lantern teaching which is often urged, is the difficulty of maintaining order, as the teacher cannot see the class and maintain discipline. I assure you that it is quite possible to use the lantern, if your light is tolerably good, under conditions when there is quite enough light in the room to see all that is going on. I will say at once that one secret of it is the abandonment of the notion, which so many people who have to do with lanterns have, that it is a grand thing to have a big disc and show your illustrations on a large scale. It is possible to use a small disc tolerably well lighted, which for educational purposes answers as well as a large one. Moreover, this apparatus is capable of being used for the projection on the screen not merely of ordinary slides, photographic or otherwise, but of a great many experiments. It is, further, particularly useful in this respect—you may have the apparatus made upon a very small scale, whatever it may be, therefore it is very portable; and if you have the peripatetic system of teaching, portability is a great element to be considered, for the teacher can then very readily carry pieces of apparatus to be projected on the screen.

[The lecturer then proceeded to give a practical demonstration of the mode of using a special form of lantern, fitted with open stage and inverting prism.]

The great thing in science-teaching is to let the things be seen, and, as far as possible, handled, and wherever practicable, the children, boys and girls, should be encouraged to repeat the experiments at home. Of the importance of demonstrations of this kind it is impossible to speak too highly, and in closing I should like to refer you to just two or three words from a most thoughtful address upon the teaching of science by Sir James Paget. The address was given to University Extension Students, but a great deal of it is of great value for our purpose. He points out that the utility of science is not only for the teaching of truth, but of the modes by which truth has been obtained. Its direct use, of course, is to establish the facts and explain the principles which it gives; the indirect use is the cultivation and refreshment of the mind. And here I cannot resist quoting a few words which were spoken one evening at the Victoria Hall, in the Waterloo Road, by the Rev. Mr. Wicksteed, who was presiding at one of the science lectures there. He said, "It will be asked, What will you gain by scientific knowledge? I will tell you. Imagine a blind man walking through a forest. He knows there are trees there,

for he knocks his head against them ; he knows there are trailing vines and flowers there, for their fibres and roots entangle his feet and trip them up : but he sees nothing of what is around him—nothing of the beautiful landscape beyond. Imagine that man suddenly gaining his sight. Instantly the trees reveal their graceful forms and their beautiful foliage. No longer do the trailing vines encumber his feet, but he revels in their luscious fruit and in the beauty of the flowers all around. It is no longer darkness, doubt, and difficulty, but all is brightness, light, and beauty. Let a man acquire a knowledge of science, and beauty will spring out of those hard problems of life he blindly knocked his head against. The very things he stumbled over will reveal themselves in forms of beauty, and his every step will be amongst beautiful flowers." Sir James Paget points out that you may divide the advantages to be gained from a study and knowledge of science roughly into four heads. First, that upon which I have insisted so strongly—the training of the power of observation ; secondly, the power of accuracy in the training of how to think ; thirdly, it is a great lesson in the difficulty of ascertaining truth ; and fourthly, the lesson of proceeding from a knowledge of what is proved, to thinking what is probable, or, in other words, the scientific use of the imagination. I may just remark, with regard

to the first point—the training of the powers of observation—that we may see without observing. It is the old story of eyes and no eyes; every discovery which has been made shows the difficulty of observing. In proof of that let me mention the name of that wonderful naturalist, Darwin. We all saw what he observed. We all saw, for example, the worms making their earth-heaps, but we did not observe and inquire; yet some of us know what wonderful facts and what wonderful deductions from those facts he drew and worked out. The great aim should be to learn to observe, and then some good will come. Then, again, accuracy in observation in recording remembrances and arranging facts should be striven after. Many of us, I am afraid, have a very low standard. We have only to look at the boundless mischief in ordinary life from careless, prejudiced, and inconsiderate people. Do we not all know people who would not for their lives tell a lie, but seem as if they could not for their lives tell the exact truth? The difficulty of ascertaining truth is enormous, and in proof of the accuracy of this statement we have but to look at the proceedings in courts of law. How does the truly scientific man proceed? He tests everything in every possible way before he arrives at his conclusions; and I desire to say emphatically that the love of science, properly pursued and properly thought of, should increase

the love of truth, and that the love of scientific truth sustains and increases the love of moral truth. Scientific knowledge is a power for the welfare of man. True, it may not be given to all of us to be great discoverers, but it is no trivial thing to be members of the same class of discoverers—to understand their language, to be able to admire their power and their skill. Scientific knowledge is happiness. It is mental recreation in its highest form. It satisfies such natural desires as the love of novelty and the love of wonder. I do not know that I can conclude what I have been saying better than by making a quotation—not this time from a clergyman of the Established Church in praise of science—but from Professor Huxley, speaking to that class of people who are the fathers and mothers of our Board School children, and pleading the cause of science. You will have observed that I have left out the aspect of science as a preparation for technical education and industries. That is the lower side of it. Although I do not wish to disparage it, yet I plead for science for its own sake as an instrument of education. With this short passage from Professor Huxley I will conclude. "Suppose," he said, "it were perfectly certain that the life and fortune of every one of us would, one day or other, depend upon his winning or losing a game of chess. Don't you think that we should

all consider it to be a primary duty to learn at least the names and moves of the pieces? Do you not think that we should look with a disapprobation amounting to scorn upon the father who allowed his son, or the state which allowed its members, to grow up without knowing a pawn from a knight? Yet it is a very plain and elementary truth that the life, the fortune, and the happiness of every one of us, and more or less of those who are connected with us, do depend upon our knowing something of the rules of a game infinitely more difficult and complicated than chess. It is a game which has been played for untold ages, every man and woman of us being one of the two players in a game of his or her own. The chess-board is the world, the pieces are the phenomena of the universe, the rules of the game are what we call the laws of nature. The Player on the other side is hidden from us. We know that His play is always fair, just, and patient. But also we know to our cost that He never overlooks a mistake, or makes the smallest allowance for ignorance. To the man who plays well the highest stakes are paid, with that sort of overflowing generosity with which the strong shows delight in strength. And one who plays ill is checkmated—without haste, but without remorse."

MUSIC

BY

C. V. STANFORD

MUSIC

THE subject of Music in Elementary Schools is one of such importance for the future artistic life of the country, and one of such wide and varied considerations, that I can scarcely expect to deal at all adequately with it in the space of a single lecture. I can only hope, by laying down general considerations, which seem to me to be of the highest importance and to have been unduly neglected by the authorities, to enlist your sympathies for my reasoning, not—even if I fail to enlist what I should prefer to have, your co-operation.

The whole introduction of music as an authorized branch of study into our school system is too recent to be perfect in its details. It would be unreasonable on my part to expect such perfection, but it would be equally unreasonable on yours to shut your eyes to the many faults which cause that imperfection. I shall therefore endeavour to point out some chief errors of system which seem to me to cry out for reform and readjustment. Even if you take exception to my crude suggestions as to

their amelioration, I shall have carried out more than half of my programme, if I make it clear to you that such errors exist. I fear I shall have to state an unsavoury fact at the very beginning of the lecture. I am in no sense of the word a pessimist, and if I have to express my belief in this unsavoury fact—a belief which is certainly borne out by the actions of responsible and far-seeing statesmen—you will see that I find some means of alleviating its results if not of eventually counteracting them. My proposition is this ; that the first effect of education upon the uneducated masses is the development of socialistic and even of revolutionary ideas amongst them. We are now carrying out a species of repetition of the story of man's fall : but with a difference. When Adam ate of the fruit of the tree of knowledge, he was under no compulsion, unless indeed you can apply such a term to the persuasive powers of a wife. We in the nineteenth century are going a step further, and are fining and prosecuting Adam's less fortunate descendants if they prefer not to eat the fruit. The gentle persuasion of woman has given place to the official compulsion of the School Board. Those of you who have watched with interest the home policy of Germany, will not fail to have noted that Prince Bismarck was alive at once to the necessity and to the danger of popular and compulsory education. He accompanied his measures of improvement by

measures of precaution. Foreseeing that the first contact of education with uncultivated minds would inevitably produce socialistic results, he passed laws for the repression of socialism almost simultaneously with his laws for general compulsory education. This stern-handed policy may not recommend itself in the least degree to Englishmen, but even if they disapprove such statecraft they must needs admire the foresight which it indicated. It is foreign to our traditions and to our sense of freedom to imitate the policy of Germany in this respect, but we are none the less forced to counteract by some means, less official but not less drastic, the very same dangers with which Germany has had to deal. We have to face the fact that the tree of education supplies the knowledge not only of good but of evil; we cannot in this country suppress the evil by legislation, unless the evil takes the form of actual crime; but we can endeavour to minimize it by increasing the influence of the good. There are many methods by which this end can be reached, methods which I need not touch on here; one of the most powerful is, without doubt, to be found in the influence of art. I am inclined to think that the systematic development of art is a lever in the hands of education which, if properly applied, will act more powerfully, if less slowly, than any measures of socialistic repression; by raising the standard of

refinement it will in time counteract by fair means the dangers born of knowledge. For art in its very essence is unselfish. Its creations are the work of one man for the use of others. The finer the creations, the wider the influence they exert.

It is my privilege to plead the cause of that art which is perhaps the most wide-reaching of all, and if the most wide-reaching, then surely the most powerful for good. Of all the arts, it is the only one which may justly be said to be at its zenith of excellence in the present century. For, with all the brilliant sculptors and painters we possess, we cannot point in the last hundred years to the equal of Praxiteles or Pheidias, of Raphael or Michael Angelo. Our architecture is but a *rechauffé* of the creations of the periods of the past. We have no distinct style of our own period which can be said to bear comparison with the masters of Greek and Gothic art, or even with the school of the Renaissance. But it can be asserted without fear of contradiction that in the century which saw the birth of the greatest works of Beethoven, music can bear away the palm as a living art at the very climax of its power and perfection. For while other arts have had their Decadence, and have passed through even their process of revivifying, music is still developing its natural vigorous existence; has not been moribund, and therefore requires no Renaissance. If I may take an in-

stance, I might remind you how some of our most distinguished English painters have harked back for their means of expression to the art of four centuries ago. In music no such step has been taken, nor will it be taken so long as it can find natural means of expression in its own process of development. I apprehend, then, that in music you have at your disposal the most powerful living agency for the refinement of the masses, and it only remains to consider how it can best be brought into use. Certain societies have, as you doubtless know, been started for the purpose of enabling the poorer classes of the metropolis to hear the best music at a nominal cost, and sometimes even free of expense. This is one most important move. It rests with the schools to educate the children of this immense and most intelligent audience to a proper appreciation of such music, and to extend that appreciation, and so still further increase that audience. The main point for us here to consider is how that best can be done. I do not deny that much has been done, but I assert most positively that certain alterations and improvements are a matter of sheer necessity, if musical education is to be properly carried on. Vast sums of money are being expended in grants for musical education in this country, and the British taxpayer has a right to claim that those grants should be properly applied and should produce equivalent results.

I am justified by statistics in putting the annual expenditure upon music grants in English schools in round numbers at £130,000, while £43,000 a year is spent upon the accomplishment known as "singing by ear." Now, I am perfectly aware that in order to induce schools to teach music at all, it must have been necessary to provide some stepping-stone to proper musical teaching; otherwise the move would in all probability have proved abortive at the very outset. For this purpose singing by ear was perhaps the only available medium. I am convinced, however, that the time has now come for discontinuing a grant for this purpose, and applying it to more useful objects. It is neither more nor less than a premium on bawling. It is of no value to music, though it may be classed as a species of amusement; but we have not yet got a government which will subsidize games. If it is found useful in a school, it should be cultivated, but not as a serious study, and only as a means of securing the interest of children for singing by note. I doubt if a proposition to recite a piece of poetry without being able to read it would be thought worthy of a grant, but it would be highly absurd to have compulsory education and be content to allow a child to leave school knowing several poems by heart but unable to read them or write them. I ask the same for music. If you teach it, teach it thoroughly by note; and cease to

give a premium for a smattering which is useless as well as superficial. The systems of note-teaching are many, but the rivalry between them is not so serious a matter for consideration. No system which teaches a child that a certain sign represents a certain sound, either absolutely or relatively, can in its essence be mischievous. What is mischievous is a haphazard training, and of all such haphazard methods "singing by ear" is the most dangerous, unless it is rapidly corrected by the influence of singing by note. What I am pleading for is, then, the augmentation of the grant for singing by note, and the extinction of the grant for singing by ear. The fact that the grant for singing by note is now two-thirds in excess of that for singing by ear, proves that it has got the upper hand in the country. If the numbers were equal there might be some excuse for delay, but the large preponderance of the systematic teaching demands in itself a strengthening of its position. The transference of the music grant for singing by ear to that for singing by note would in itself be an additional inducement for developing that branch of study; while if teachers found it in any instance advisable to begin by ear-training alone, we should at all events have some security that such training would only be used as a means to the end which we desire.

There are, of course, here, as in all reforms or improvements, some difficulties in the way. It is

difficult to raise your building a story without interfering with some ancient lights. Your ancient lights are those masters of schools in more remote districts, who are not sufficiently trained in music themselves to teach it by note. This is no doubt a difficulty, but it is one which time will surmount. If a proper inducement to the study is held out, the teachers will gradually qualify themselves to take advantage of it. They will never do so so long as they get a grant for the easier and more haphazard method. But the taste for music in the country is increasing at so rapid a rate, that every year will increase the number of persons qualified to teach music by note. Supposing, then, that this transference of grant was carried out, there arises the question of its application. It might be applied in two ways: either by increasing the grant for any or all systems of training by note, or by preserving the present grant to modern systems of notation and reserving the extra allowance for proficiency in the old notation. Without taking any hard-and-fast line upon these alternatives, I feel that I ought to weigh as far as possible the pros and cons of them. Let me say at once that no one is more convinced than I am of the great value of and the great services rendered by the Tonic Sol-fa notation. It has without doubt simplified vocal music in a most marked way, and has cultivated to an extraordinary extent the

power of singing intervals at sight accurately and in tune. For school purposes and for vocal music it is simply invaluable. Moreover, it is of the greatest use to the many choral societies in country parts where all the singers are not conversant with the old notation. But, on the other hand, the great mass of instrumental music and of modern classical works are a sealed book to those who are exclusively trained in letter notation. I am well aware that it is one of the most important developments of the Tonic Sol-fa system that one of the greatest difficulties which musicians felt to it is being removed, namely, the finding of some means whereby the reading of the old notation can be led up to by Tonic Sol-fa training, without a recommencement of the entire study. To encourage this development seems to me to be eventually the obvious policy. Neglect of the sense of absolute pitch as distinct from relative pitch—in other words, the sense that a certain sound represents a certain fixed note—is the greatest sacrifice which musicians have had to make in approving the system of the movable Do. No one who is not experienced in musical training can be expected to appreciate of what immense value the sense of absolute pitch is. I must ask you to take it on trust. In supporting as I do most cordially the Tonic Sol-fa system, I am aware at the same time of what I am sacrificing. It is worthy of consideration whether the teaching

of the old notation might not be a higher optional step to which this extra grant might be applied, without penalizing in the smallest degree the present systems. We should then reap the full advantage of both: we should, on the one hand, gain the relative pitch without ignoring the absolute, in the higher classes; and we should be enlarging the range of musical literature within the reach of the higher scholars. I conceive it to be of the highest importance for the cultivation of music in this country that the bridge between the Tonic Sol-fa and the old notation systems should be made as practical and as easy as it is possible to make it, and that every inducement should be held out for proper mastery of both. At the same time, I thankfully admit that a scholar who leaves school with a knowledge of the Tonic Sol-fa system only, has mastered quite enough to be useful and even ornamental, and quite enough to justify the grant which he is instrumental in securing. So much can certainly not be said of singing by ear.

Having so far discussed the desirable reforms in the matter of how to sing, I wish to go a step further, and suggest some quite as important considerations in the matter of what to sing. Here I confess I am somewhat amazed that more definite care has not been exercised by those in authority. As far as I am aware, very careful consideration and supervision is exercised as to the quality and

nature of the prose and poetry which is placed before the children in our schools. But with regard to the quality of the music there must be very little of such supervision, and that of a very perfunctory nature. It is rather assumed, I imagine (if I am wrong I am open to correction), that the inspectors of schools are a safeguard in such a matter; and, in the matter of general education, they undoubtedly are. But surely you are expecting too much from a body even of such able men as the inspectors of schools, if you trust to them for a sufficient knowledge of and taste for music to enable them to be equally sure in their judgment on that as on other general branches of education. Many of them, no doubt, happen by accident rather than design to know a good deal about music. But it is not to be in justice expected of them that they should be sufficient masters of the craft to regulate this important study. They can and do see that the words sung will pass muster; they cannot be so sure of the music to which those words are sung. I would impress upon you the vast importance of allowing no music to be sung in the schools which has not been approved by some responsible body of musicians, and duly authorized upon their responsibility and advice by the School Board. It should be made as impossible for the children to be taught bad music as bad books. And unless they are taught good music, it would be far better

to omit the study altogether. I venture on this head to throw out a suggestion for your consideration. Our two leading institutions for the cultivation of music, the Royal Academy of Music and the Royal College of Music, have just combined for the purposes of conducting local examinations in various centres of the British Isles. For the purpose of carrying on this organization, a board consisting of the most responsible musicians connected with both institutions has been formed, of which H.R.H. the Prince of Wales is President. If such a board as this were to undertake the supervision of a series of systematic school music-books, there could practically be no doubt of their genuine value. Against this idea it may be asserted that you have an inspector for music already, who might fairly be expected to supervise such books. But it is only right to remember that such a responsibility is a heavy one indeed for any one man to bear, however great his ability; and what is much more serious, the rejection of many worthless books would be attended necessarily by much ill-feeling and even odium, the burden of which should not in justice be placed on the shoulders of any single individual. And what should be the kind of music taught? Without doubt, national music, folk-music—the music which from the earliest times has grown up amongst the people. Without the foundation of such music no healthy

taste can be fostered in the population. From all times it has been the germ from which great composers have come. Need I point out to you as a proof, that those countries which have the greatest store of national music have also produced the greatest amount of creative genius as well as of general appreciative power? Compare for a moment Germany and Italy, with their vast treasures of folk-music, and their grand list of masters of composition, with, for instance, a new country like America. In the former countries the nationality has become so rooted and individualized that national music has had sure ground to grow upon. In the latter you have a mixed collection of all nationalities which is only in process of formation into an individual whole. The characteristics of a nation, it is true, are forming there with remarkable rapidity, but there has not yet been time for the national music to grow. They, therefore, as yet have not produced their Bach or Beethoven.

Folk-music is not easy to define. It grows in a country; it can only in a few instances claim a distinct composer, and then usually a name unknown, obscure, or forgotten. In Hungary, where it is still in process of lively production, a tune is literally put together by passing from mouth to mouth, beginning with some simple phrase and developing to some complete song. Of such a character was a most stirring march-tune, which

developed itself in the ranks of the Hungarians when they occupied Bosnia after the Treaty of Berlin. This tune owned to no particular author; it grew. Any of you who have heard a chant of sailors heaving up anchor would perhaps be surprised if you knew that such a thing as this is folk-music in its simplest form. In some countries this process of development of folk-music is in greater activity than others. In Hungary it is at fever-heat still. In Russia it is not far behind. Even in England it is not totally extinct, although it is not rapidly produced. Still songs are here produced which, although of lowly and even vulgar origin, possess a certain English stamp, and may, after the refining processes of time have done their work, be included in some collection of national music a century or two hence. I should probably horrify you by instancing the notorious tune of "We don't want to fight" as just such a song; it contains some vulgar phrases and illustrates what to some may be objectionable sentiments, but in spite of that it has a true British ring about it. It would not be the first folk-song which has begun by being the organ of a political party, and ended by meeting with a general acceptance quite independent of its associations. I am not recommending it for immediate use in the schools; we can leave that to the judgment of the next century.

But if you will admit my proposition that the healthy musical taste of a nation depends upon the wealth of its literature of folk-music, I will, as a result of your admission, point out that in the British Isles you have the greatest and most varied storehouse of national music in existence. You have two distinct schools—Saxon and Celtic; and four distinct styles—English, Welsh, Scotch, and Irish. The English, strong, solid, and straightforward; the Welsh, full of dash and "go;" the Scotch, a mixture of humorous and poetic, full of strongly marked rhythms, dry and caustic at times, full of a quality which I can best term "lilt;" the Irish, which to my mind, speaking as impartially as an Irishman can, is the most remarkable literature of folk-music in the world,—there is no emotion with which it does not deal successfully, and none has more power of pathos or of fire.

With such literature as this at your disposal, there surely need be no lack of ground-work for teaching music in your schools; but these old bulwarks of your national art must be made the basis of your teaching.

I should also suggest, with a view to developing the interest as well as the natural tastes of the children of various nationalities and proclivities with which you have to deal, that the music chosen for them should be at first that which comes most

home to them ; that you should in England start with English folk-music, in Wales with Welsh, in Ireland with Irish, and in Scotland with Scotch ; and, to still further subdivide matters, that sea-songs should be cultivated in the maritime districts, and so on. But not exclusively in any one. After a course of education in the music indigenous to each race, a course in that of their neighbours and compatriots should follow. And here it would be important to select the order in which the stranger folk-music should be presented to each section. I am of opinion that it should be laid before them in the strongest contrast possible. My scheme would be this—

FOR ENGLISH SCHOOLS.

1. English National Folk-music.
2. Irish ,, ,,
3. Welsh ,, ,,
4. Scotch ,, ,,

FOR WELSH SCHOOLS.

1. Welsh National Folk-music.
2. Scotch ,, ,,
3. English ,, ,,
4. Irish ,, ,,

FOR IRISH SCHOOLS.

1. Irish National Folk-music.
2. English ,, ,,
3. Welsh ,, ,,
4. Scotch ,, ,,

FOR SCOTCH SCHOOLS.

1. Scotch National Folk-music.
2. Welsh ,, ,,
3. English ,, ,,
4. Irish ,, ,,

It is by strong contrast that the interest of children is most surely enlisted. It is, therefore, doubly fortunate for British schools that, without going outside their native productions, they can secure such contrasted styles as those I have enumerated. Much also depends on the manner of their presentation to the pupils. They should, for the sake of the preservation of the old melodies in their purest form, be most carefully edited, and such accompaniments as are thought advisable should be added in the best taste. Of such tunes the schools would be in fact the preservers, for it stands to reason that what a child has learnt as part of his daily education will grow up with him in the form in which he imbibed it at school. A careless misreading or unnecessary alteration may be the means in the future of the destruction of the beauty of an old melody. To deal with this, you want wise heads and cultivated brains. It will be no easy matter to purify some national music from excrescences which have appeared in it in later and more careless times. In the case of so patriotic and so enthusiastic a national music lover as Thomas Moore, it is scarcely possible to find a page of Irish folk-music which he touched without unjustifiable and, I must say, destructive alteration. In English music and in Scotch we are more fortunate. Mr. William Chappell and the late Sir George Macfarren did much to preserve

home to them ; that ... England start
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3. English ,,
4. Irish ,, ,,

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its purity from the additions of Vandalism. For the pure melodies of Ireland we have to trust to such lesser-known antiquarians as Petrie and Bunting, the former of whom published a volume of vast importance, which is now only obtainable by sheer luck. In Scotch music we shall be safe, thanks to our possession of a man of such purity of taste and mastery of the subject as the Principal of the Academy of Music, Dr. Mackenzie. In this, as, alas, in other matters, my nation is the most distressful, and has suffered most from careless and unscrupulous mutilation of its national music. Moreover, she cannot lay this to the charge of the Sassenach, inasmuch as her own sons are the chief offenders.

Such a work as this supervision of national music for our schools involves, ought surely to be placed in the hands of our responsible leading musical men, and no collection should be issued until their approval of them has been obtained. Moreover, it is necessary, as part of such a systematic reform, that no books whatever should be used except those approved by such a board of authorities as I have indicated, and any extra songs should be introduced only after the national music had been thoroughly taught as the artistic daily bread. As soon as these collections have taken root firmly, then, and then only, should be considered the advisability of a further addition—the best songs

of other countries. But it would be hard to gauge the mischief which might be done if such a move were made too soon. Exotics have always a fascination about them which it is hard to resist, and you must train your children to appreciate daisies before you present them with orchids. Moreover, this fascination may result in their thinking the home-growths tame, and we all know that familiarity even in folk-music may breed contempt. If I may once more take the example of my own country, Ireland, it is a sad fact that Christy Minstrel songs are driving the superb Irish folk-music out of sight and out of mind. In the neighbourhood of the towns the "darkie" invasion has been fearfully successful. It is now only in the harvest-field, and in remote districts where the melodies sacred to burnt cork are still an unknown luxury, that the genuine ring of the Irish style is preserved. Such disaster as this it is for the schools to avert. I do not deny that the results will want time for their development. But that is no reason for the delay of reform. I would impress upon you that, in distributing musical education among the masses, you are not only doing general good and mitigating evil by the powers of refinement, you are also incurring great responsibilities. Amongst your thousands of scholars, you may be entertaining angels unawares. For all you or I can tell, the genius of a Mozart or a Beethoven

may be latent in some child whose taste you are the first to cultivate. Take care that you give such a one the chance of being grounded and developed in the right way. Some small insignificant plant which you are rearing may blossom and bear fruit out of all proportion to your expectations, and even become a possession for his country to boast of. Great men have mostly had the foundations of their greatness laid in the nursery and the schoolroom. It rests in your hands to have a care that this early training is, in matters of art as well as of general education, of the best kind in itself and carried on upon the soundest lines. The greatest composers have sprung from the heart of the people; it is with the heart of the people that you have to deal, and it is for you to give the opportunities for their development. If you only rear the taste and start the training of one great composer in a century, he will be worth waiting for, and will repay all the pains and trouble and cost of the machinery of production. With well-laid principles you may not have a century to wait.

THE NECESSITY OF

PHYSICAL CULTURE AND RECREATION

BY

COLONEL G. M. ONSLOW

PHYSICAL CULTURE AND RECREATION

I AM very glad to be granted this opportunity of stating my views on a subject the importance of which I think it is impossible to overrate, and this is the pressing urgency of proper attention being paid to the physical culture of the masses at the present time, for upon the physical as much as upon the mental condition of the people does the strength, prosperity, and stability of a nation depend; and for this reason (and there could not be a stronger one) I feel it to be my duty, whenever a fitting occasion offers, to advocate the establishment of a rational system of physical culture in all elementary schools throughout the kingdom, and to impress upon all those who are responsible for the training of the children of the masses, the supreme importance of encouraging and facilitating physical recreation among them, more especially in our large towns and cities. And I purpose dwelling upon the benefits attending the two, not only to the individual, but also to the community at large; and I shall insist on the vital necessity

of both as being a means, and a potent means, of sustaining the health, and preventing deterioration in the physique of our vast and sadly overcrowded urban populations. From the fact that Government after Government in this country, as represented by the Educational Department, steadily, continuously, and persistently ignores the necessity for, and burkes the question of the "physical education" of the people, it is a source of much gratification to me to find so great a public educational body as is the School Board for London recognizing the importance of the subject. This is shown by the manner in which they have already commenced to deal with one branch of it, and I sincerely trust that the opinions held by its members may be shared by most of my readers, and I hope that, should there be any who have not given the question the thought and consideration it undoubtedly deserves, it may be my good fortune to be instrumental in stimulating greater interest in it on their part, and in directing the current of their thoughts into channels perhaps not previously examined—especially in the case of the managers of the London elementary schools, than whom I cannot conceive of a body whose aim and object it should more particularly be to arrive, by careful thought and due consideration, at a sound conclusion on the merits of the case; or whose duty it is, after having convinced them-

selves of the necessity of cultivating the physical powers of the children entrusted to their care, and whose general education they supervise, to endeavour to give their opinions definite form and practical effect.

I may be asked, firstly, why it is that I consider physical culture so urgent and pressing a matter now.

Secondly, what I mean by physical culture.

Thirdly, what are the principal advantages that I claim as attending it and physical recreative exercise.

I will answer the three questions categorically. The Earl of Meath, in a work entitled "Prosperity or Pauperism," which some of you may possibly have read, makes use of the following ominous words: "It is a well-known and universally recognized fact that, the more people are crowded together, the more unhealthy do they become."

Now, if such be accepted as a fact (and, other things being equal, it may be so accepted), two-thirds of the people of England must now be living under conditions more or less prejudicial to health; for let me remind you that at the present time there are *two* people born in towns to *one* person born in the country, and what is prejudicial to the health of a people must in the long run be so to their physique. As we cannot now afford to neglect any opportunities of mitigating so grave

an evil, and as physical education and recreation are potent means among others for counteracting it to a great extent, it is our duty to avail ourselves of them as far as possible, and to insist upon physical culture being given its proper place, and included in the curriculum of our elementary system of education.

I think it will be generally admitted that the aim of all education should be to produce good and useful citizens, and the man is not a thoroughly useful citizen who, however intellectually clever and accomplished he may be, breaks down and collapses in the midst of his labours for the want of bodily endurance and stamina. Cultivation of these latter qualities, then, is essential to enable a man to hold his own in the present great struggle for existence, and education of the bodily powers, like that of the mind, must be conducted while the frame is pliant and impressionable—that is in youth, during the period of growth.

Now, physical culture should, in my opinion, be classified under two heads—educational and recreative—and I propose to deal with each separately.

If you mention to many people the subject of physical education, they either stare blankly at you, or there arises a vision in their mind's eye of a room or playground in which are a number of children swinging about on ropes, or turning heels

over head on bars or vaulting-horses, or working away with clubs and dumb-bells, and apparently graduating as athletes; but this impression is absolutely a false and erroneous one of what it really is, and I fear it has done, and still does, much to militate against a sound and proper system being adopted in English schools.

Now, I interpret physical education to mean that children should be instructed in the elements of physiology and hygiene, and be taught certain simple rules for the preservation of health, such as the importance of good food and pure water, fresh air, the desirability of wearing easy-fitting clothing, of cleanliness in their persons and habits, and the necessity of taking proper exercise and sleep, etc. Not only should these seeds be sown in their little minds so as to bear good fruit in after-years, not only should these matters be taught them in theory, but their advantages should be practically illustrated and brought vividly home to them by the most scrupulous attention being paid to the ventilation, light, temperature, and surroundings generally of class-rooms and their offices, and by every precaution being taken to guard against the presence of all insanitary influences in or about either the school-houses or playgrounds, in the form of untrapped drains, ashpits, manure-heaps, or other unsavoury and dangerous nuisances. Due regard should also be given to the cubic feet of

space to be allowed to each child, which should be ample, for children breathe more frequently than do adults; careful attention should be paid to the positions of the children while reading, and more especially when writing, and they should not be allowed to remain in any one position too long; the forms they sit upon should be provided with backs, and their desks should be of a suitable height; for you may rely upon it, that neglect of all or any of these details cannot fail to be attended by permanent mischievous consequences. Teach the children something of these matters while they are at school, and shortly there will be, in place of the deplorable ignorance concerning them which unhappily now exists in most quarters, a pretty general knowledge and appreciation of their importance throughout the country, to the great and lasting benefit of the whole people. I say that all these details I have enumerated form unquestionably one part, and a very important part, of physical education, and for this reason—that while you are thus teaching the children what is beneficial and what prejudicial to their physical well-being, you are at the same time subjecting them to influences that cannot fail to improve their health and help to build up their bodily powers, and to assist in counteracting the injurious effects of the unwholesome and debilitating conditions under which, alas! but too many of them are living in

their own wretched homes. But you must not stop here, for there is more still to be done; and it is by establishing and steadily practising the little ones in a sound system of free movements and exercises the practical development of their muscular powers must be ensured, and a uniform and harmonious improvement of their whole frames effected; for health, and *general*, not *partial* strength, must be the object aimed at.

To guarantee the attainment of these results in a safe and rational manner, it is absolutely essential that those who teach should themselves be sound and healthy, and be capable of performing these exercises perfectly, that they should have a thorough appreciation of their purpose and value, and that they should also be able to give instruction in the elements of physiology and hygiene. Furthermore, they ought to be under the supervision of a director of physical exercises, whose duty it should be to visit the several schools from time to time, and to report to his Board whether or no the system is being intelligently, efficiently, and carefully administered.

In the Education Act of 1870 I see no mention whatever of physical exercises, but I observe that provision is made for allowing, "for boys, military drill under a competent instructor for not more than two hours in any week," etc. Why military drill? They are not all going to be soldiers—in

fact, but very few will enter the army—therefore why stipulate for "military drill"? Although an excellent thing in its way, physically it can benefit children but little, and I look upon two hours a week devoted to military drill in elementary schools as so much time wasted. Allot the same time to the practice of proper physical exercises under competent instructors, and we should at once be conferring a lasting blessing on the boys themselves, and on the community in general, and we should be fulfilling a manifest duty to future generations—a matter which I much fear is but too apt to escape altogether the attention of many people.

In this same Act, and in the identical clause, I notice that the girls are not even allowed "military drill," but for them "practical cookery" is mentioned. Now, if those who drew up the Act had it in their minds that "military drill" would tend to improve the boys' physique (and I cannot see what other object they could have had in view in introducing it), why, may I ask, were the poor "girls" left out in the cold, and, as it appears to me, put off with "practical cookery"? This latter is, I admit, a most important science, and one to be cultivated, not neglected; but it can hardly be accepted as a substitute for military drill, and can only be regarded as being very indirectly connected with physical improvement, except perhaps with

that of those who may be fortunate or unfortunate enough to have to eat what is cooked. No, if it is necessary that boys should receive physical instruction (in whatever form it may be given), it is equally necessary in the case of the girls; for it cannot be denied that the bodily strength and soundness of constitution of future generations of Englishmen depend as much on the health and stamina of our women of the present as on that of the men, and we cannot afford to ignore the fact that, if the boys are to become the fathers, the girls are to become the mothers, of posterity.

With this before us, I maintain that we should give the question of children's bodily culture, and of healthy recreation, due prominence, and we should strive to cultivate their material and mental powers concurrently, not forgetting "that youth will never live to age without they keep themselves in breath with exercise, and in heart with joyfulness."

For young children of the classes mostly to be met with in elementary schools, many of them poorly fed and ill cared for, systematised exercise in the shape of "free gymnastics" is in my opinion what is safest and most suitable, and better calculated to produce general and uniform development than any other, and also to teach them co-ordination of movement—that is, to habituate the limbs to a ready obedience to the dictates of the will.

These free exercises have this great advantage—they require an open space only for their practice, and while they are unattended by any risk of straining young and tender frames if scientifically taught, will do as much and a great deal more than military drill in the way of teaching the little ones how to march, and in giving them an upright bearing and easy carriage. Moreover, as their correct execution depends on attention and prompt obedience to the words of command, they tend greatly to inculcate habits of discipline; and, in addition to this, they cost nothing, apparatus being wholly dispensed with.

I do not go so far as to argue, as do some advocates of "free movements," that by them alone the same development can be attained as by exercises on apparatus; but, while fully recognizing the great value of these latter, under certain conditions and for certain specific purposes, I do maintain that for the bodily improvement of the children of the masses, among whom, sad to say, so many are to be found who are constitutionally unsound, whose physical powers are impaired by disease, neglect, poor feeding, poisonous atmospheres, etc., and among whom are so many who are afflicted with congenital and other deformities —for these there is nothing, in my humble opinion, to compare to a rational system of "free exercises." The children in question can only be taught col-

lectively, not individually, and for this reason, and owing to the danger of accidents if they are allowed access to the apparatus without skilled and constant supervision, I am averse to its use, even if the serious expense which its provision would involve did not render it prohibitive.

To summarize briefly what I have advocated: physical education, theoretical and practical, should be compulsory throughout the United Kingdom; it ought to be State-directed, and conducted on well-considered scientific and rational principles; and it should be recognized as an integral and an important part of a child's general education.

I consider that three hours a week devoted to practical exercises should suffice, but not more than half an hour on any one day, the best time being in the afternoon, but not too soon after the midday meal.

Now, in speaking of meals, I am reminded of a grievous fact that must on no account be overlooked, and it is that, in the case of a certain proportion of the poor little creatures attending elementary schools, the *one* thing they require above all others is a good "square meal," and without first filling their little craving stomachs with something substantial and nourishing, there can be but faint hope of much, if any, benefit accruing to them from education of whatever kind; and how to tackle and overcome this sad and

terrible difficulty is a problem not easily solved; but it is, I know, now engaging the earnest and anxious thought and attention of those best fitted, by their knowledge and experience, to deal with it, so to them it must be left. Before approaching the second part of my subject, I would wish to particularly point out a fundamental principle in "exercise" which must never be lost sight of by those who are responsible for the training of youth, and it is "that exercise must always be regulated by the fitness of those who undergo it," and those who instruct should endeavour as far as possible to make themselves acquainted with the physical capabilities of those they are instructing, and to accurately gauge their strength and powers, which latter should never be taxed to the verge of exhaustion; and too much caution cannot be observed in this respect when dealing with the underfed, badly nurtured, neglected children of the very poor and thriftless inhabitants of our great towns and cities.

Now, having so far dealt with the subject in a purely educational sense, let me consider it under its second head, and examine the advantages of physical recreation for the masses, which I confess I look upon as so powerful a factor in the formation of individual character as to be inseparable from the question of the general education of a

people. I also regard it as essential to the physical and moral well-being of the youths of our town-bred population, subjected as they are to influences highly prejudicial to their healthy bodily condition, and therefore calculated to lower the standard of their physique. That these pernicious influences are at work, is, I fear, clearly evidenced by the large number of rejections of men offering themselves for enlistment in the army, and for employment as porters and in other capacities on our railways, on account of physical disqualifications, which is an indication of mischief brewing in the quarters I have named. We should endeavour, therefore, to cut at the root of the evil before it strikes too deep.

The late Lord Beaconsfield made use of the following portentous words in a speech he once delivered in the Free Trade Hall in Manchester: "After all, the first consideration of a minister should be the health of the people. . . . If the stature of a race diminishes in every ten years, the history of that country will soon be a history of the past." Well, with the elements of such a danger in our midst, whether they have already begun to take effect or not, it is nothing short of insanity on the part of the Government, of educational authorities, and of all others concerned, having any patriotism in them, or any interest in the welfare of their poorer brethren, to neglect

a measure by which it is obvious so great an evil may at any rate be mitigated ; for I firmly believe that one of the surest antidotes to over-pressure (so much talked of in these days), to the evils attending overcrowding and the gravitation toward urban centres which is now so steadily in progress, is to be found in rational physical education for the masses, and wholesome recreative exercise, combined.

We may say that there are three things essential to keep us alive, and to build up and sustain in proper working order our bodily powers, and they are *food*, *air*, and *exercise*. The first two should, of course, be unadulterated and pure, and the third should be regular and hard, but not excessive. Well, then, speaking broadly, the three things that are obviously requisite to counteract degeneration in the health of the town populations, and the physical deterioration which must inevitably follow it, are, firstly, *better food;* secondly, *healthier dwellings;* thirdly, *healthy recreative exercise;* but it is with this latter only that we have on this occasion to deal. Now, it occurs to me that, in order to enable one to fully appreciate the necessity for and advantages of exercise, it is requisite that one should have a general idea of what exercise is, and of the working of one's muscular system ; also of how the blood circulates throughout the human frame, the duties performed

by the two towards each other for the benefit of the whole body, and how they are assisted in performing their respective functions by "exercise."

I don't suppose any one has ever taken a good sharp walk on a bright frosty day, or rowed up the river on a fine summer's evening, or played a good game of cricket or football, or, in fact, taken any sort of brisk vigorous exercise, which has moistened his skin, opened his pipes, and accelerated his pulse, without feeling more or less exhilarated, and all the better for it; yet there is I imagine, not one man in a hundred who, though fully aware that he *does* feel the better and the fitter, could tell you why it is he does so, or could give the reason for the pleasurable sensations which follow active exercise, or explain why, if he takes it systematically and regularly, he always feels well and strong, and soon gets into what is commonly called "condition."

The term "condition" is one more expressive than any other I know of the high state of health of mind and body which we would all like and all ought to be in, but which cannot be attained by any one, high or low, rich or poor, without regular healthy exercise. Now, what is "exercise," and how does it affect our system?

It has been defined as muscular movement produced by muscular contraction, by which every motion of the living organism is accomplished.

Our muscular system is composed of *two* sets of muscles — *voluntary* and *involuntary.* The voluntary muscles are those which are (or should be) subject to the direct control of the "will." They are distributed over the whole framework of the bones, and are again divided into two series, namely, the "flexor" and the "extensor;" the former being principally situated on the inner side of the limbs, the latter on the outer, and they are the organs by which the bones themselves are moved. They are endowed with the property of contracting, or becoming shorter, whenever called upon by the "will" to perform any work. For instance, if you wish to take off your hat, the "flexor" muscles bend the arm and raise it, and the "extensor" muscles lower the arm and straighten it when you have finished the operation, and want to put your hand down by your side again.

The human frame is composed of myriads of atoms, each of which preserves its vitality for a given period, then dies, is separated from the tissue of which it is a part, and is eventually cast out by the organs of excretion—that is, through the skin, the lungs, the kidneys, etc. Now, "exercise"—that is, contraction of the voluntary muscles—greatly expedites this decay of tissue, and every time a muscle is moved certain atoms of the tissue composing it are destroyed. Well, of course, if this

decay and destruction of material were to go on without some counteracting process being at work, the result would very quickly be loss of size and power, until men became mere skeletons; but there is all this time a reparative process in action, and it is carried on by the nutritive system, through the medium of the blood. Now, the organs of the nutritive system, the digestive organs, convert our food into blood, which latter then contains nearly all the constituents necessary for the building up of the wasted muscular tissue and the replacement of what has been lost; and the blood, with its renovating material, is pumped by the heart to every part and to every tissue of the body, restoring and rebuilding what has been destroyed and cast out; and not only does it do this, but in youth, during the period of growth, and until the limit of individual capacity of development is reached (and, of course, there is a limit to this, as to everything, or else, if you worked hard enough, you would become as broad as you are long), well until the limit of development is reached, the supply of this renovating tissue in a healthy, fairly fed body always *exceeds* the decay, and it is in consequence constantly and steadily being built up and enlarged.

As I have just said, the blood is the vehicle which conveys this developing material throughout the muscular system, and deposits it wherever it is

wanted; but, in addition to doing this, it acts also as the "scavenger's cart" for removing the useless *débris* cast off from the muscles by the action of exercise, and it performs the double duty in this way. The blood is, as you know, constantly circulating from the heart—a hollow conical muscle containing two sets of chambers, one set being on its left, the other on its right side, with no direct communication between them. Well, now, starting from the left side, the blood is propelled by contraction into a large artery, whence it flows through a perfect network of others, which get smaller and smaller as they get further away from the heart, and approach the extremities of the body; and, having done its work, it returns again by the veins to the right chambers of the heart, and from there it is pumped into the lungs. Now, in its passage from the left side of the heart, whence it started fresh and pure, and laden with the building-up material already mentioned, it drops its good substance wherever needed, and at the same time it takes up the decaying useless atoms of tissue in the form of carbonic acid, and, as I have before said, it passes into the lungs, which are so constructed that the instant it enters them it comes in contact, in the act of respiration, with the atmosphere, which, if good, purifies and restores it with the life-giving element "oxygen," and, charged with this, it flows thence straight to the left chambers

of the heart again, to be pumped as before into the arteries.

This action commences the instant a man is born, and continues to the hour of his death. In the act of expiration the foul carbonic acid (the *débris* I spoke of), with which the blood is full when it returns to the lungs after its journey round the body, escapes into the air in the form of carbonic acid gas.

This cleansing of the blood of its impurities is still further assisted by a proper action of the skin, or, in other words, "a good sweat," than which latter *nothing* is more conducive to health—especially when followed by a good "rub down" with a rough towel.

The foregoing illustrates that "exercise" (that is, "contraction of the voluntary muscles") causes the more rapid decay and disintegration of the atoms composing them, and their consequent growth and enlargement, and the harder and faster the exercise, within certain proper limits, and the purer the air breathed, the more oxygen is there inhaled, the quicker is the renovating and developing process accomplished, and the tougher and stronger does the muscular system become.

Now, whenever one of the *voluntary* muscles is put into motion, there is a corresponding action of some of the *involuntary* muscles in connection with it, and these are the muscles of the heart, lungs,

kidneys, liver, and digestive organs generally, over which the will has no control; but it is upon the soundness and proper condition of these that a man's bodily and, indeed, mental health depends, so that "exercise" not only strengthens, develops, and toughens the voluntary muscles of the body, and by expanding the chest gives the lungs greater breathing capacity and power, but at the same time, by continually flushing the organic system and brain with pure oxygenized blood, it keeps both in a high state of health and vitality, and makes a man, in mind and body, sound, hardy, and robust.

Such, briefly, is the general effect of healthy exercise on the human frame, and though much of what I have been saying may be doubtless well within the knowledge of most of you, I must ask you to pardon me for having thus touched upon it, as it was necessary for me to do so in order to emphasize my argument, and for the purpose of demonstrating that it is absolutely impossible for any one to attain to a perfect condition of health, of either mind or body, without proper exercise.

No men or women can be considered thoroughly educated or properly prepared to fulfil their own duties, or their duties as citizens (the object of education, mind you), unless their physical training in youth receives proper attention; for increased physical power means increased capacity for pro-

ductive labour, and health and vitality of the body means improved energy and activity of the mind; for the action of the mind being dependent upon a *material* organ, the *brain*, this latter (like any other organ), to be kept in sound health and vigour, *must* be flushed with an adequate supply of pure oxygenized blood. And mark this—it is the mind and body *together* that make the whole man. To exclusively educate one and neglect the other, whichever it may be, is to fail to do full justice to either. God has united in us a *twofold* nature, and He expects us to expand and cultivate both parts in order that they may afford each other mutual help and assistance in performing their respective tasks. In fact, the intellectual faculties must be prepared by exercise for their future development; for, as Rousseau truly says, "to develop the mind of a man, you must develop the power which that mind has to govern. Exercise his body to make him healthy and strong, so that you may make him prudent and reasonable."

Well, so far I have been treating of the necessity of becoming strong and healthy; but there is another very important acquirement to be sought after by all young people, namely, "activity," and the want of activity observable in numbers of the working classes is simply deplorable and past belief, and for this I can vouch from my own experience among recruits, of whom many thousands

pass through our Military Gymnasia annually, to their great improvement in this and other respects. You cannot very well be really active without being strong, though you may be very strong without being active; but you lose half of the advantages of your strength if you are wanting in activity. Activity of the body means a ready and immediate obedience of the muscles and limbs to the dictates of the will; and activity of the mind means the capacity to rapidly grasp a situation, to instantly take in its advantages or difficulties, as the case may be, and to quickly determine how to act.

Now, this activity is acquired by establishing a habit of rapid contraction of the muscles in swift obedience to the mandates of the will, and this habit, again, is greatly assisted and promoted by playing manly games, and by taking sharp vigorous athletic exercise of a character calculated to bring into energetic use every muscle of the body, thereby ensuring its full and perfect conformation. Every portion of a good machine is in equal working order, it is perfect in all its parts; and this is what we should try to make the human body. I lay great stress on this, because it is a sad fact that the majority of people are stronger and better developed on one side than on the other—generally on the right side; at any rate, among the working classes it is on the side most

used in the work by which they earn their daily bread. But this is all wrong. Each side should be alike in size and shape, the muscles of one arm or leg in the same stage of development as the other, otherwise the result is frequently wry neck, round shoulders, spinal curvature, and other distortions of the frame and limbs. Then, again, if one set of muscles is allowed to fall behind the others in cultivation and size, there is loss of strength, activity, and endurance of the whole body; for the strength of a chain lies in its weakest link.

It is for this reason, among others, that it is so desirable, so imperative, that our youths, "boys and girls," should undergo systematic physical training while at school—should have opportunities afforded them, whenever possible, of playing the numerous glorious outdoor games which flourish in this country, and of receiving instruction in recreative gymnastics; as by this means one set of muscles are exercised at one time, a different set at another, thus ensuring their general improvement, and the consequent regular performance of all the functions of the body.

Now, there is no country in the world where the love of athletic pastimes, or manly sports and games, has such deep root among the population as in England, and there is no people with such a superabundance of animal energy; but it is among

a comparatively small portion of the community only that any facilities at present exist for indulging in these manly sports, or of getting rid in a safe and rational manner of this same superfluous stock of energy. The majority of our best outdoor games are expensive to play, can only be played during the day, and require large open spaces for their performance. These three conditions (or any one of them alone, indeed) must render it impossible for the masses (the working classes) to indulge in them ; and the great majority *is* the masses. It is they whose occupations are irksome, monotonous, and more often than not followed under conditions most injurious to health, and tending to stunt and distort the natural growth and development of their bodies ; it is they who have to stick close to their desks in hot, ill-ventilated offices, or to daily breathe the tainted dust-laden atmosphere of the warehouse and factory, and who are compelled to live in crowded courts and narrow streets, where the air is stagnant and foul ; it is they who have to sleep in squalid rooms that never get flushed with pure and unpolluted air, without which it is impossible for man, or indeed any animal life, to flourish and thrive ;—they are the beings to whom healthy recreative exercise in fresh pure air is all-essential and an absolute *necessity*, not alone, as I have already said, for their own individual good, but for the health of the community at large. And

yet it is they who are the very ones for whom so much even in these present days still remains to be accomplished in regard to this all-important subject.

Owing to the many insuperable difficulties which stand in the way of the majority ever getting a chance of playing these outdoor athletic games, there is the greater necessity for the passing of an Education Act, embodying in its code compulsory physical culture of a scientific and rational character; and the statesman who accomplishes this will deserve well of, and will command, the deep gratitude of the nation. But this long-continued delay is dangerous in the extreme, and I only pray that the necessity for cultivating the bodily powers of our steadily increasing urban poor, and of toughening their muscular fibres, may never be forced upon the minds of the British people, as it has been on the minds of most of the great continental nations, by a crushing military disaster; for it is a fact that the Germans, Austrians, French, and Russians, every one of whom have now adopted national systems of compulsory physical culture, were each and all unconvinced of the folly, the sin, the *insanity* of neglecting it, and remained blind to its vital necessity, until their eyes were opened and it was brought forcibly home to them by cruel and bitter experience gained in war, and by the stern lessons taught

them on unsuccessful battle-fields and in disastrous campaigns. It may here not be out of place to mention that Monsieur Gambetta, in 1871, after the Franco-Prussian War, so humiliating to the former, in a speech he made at Bordeaux, attributed the loss by the French of the provinces of Alsace and Lorraine, to the physical superiority of the German soldiers ; and in great measure he was right.

But to return to the subject of physical recreation. I wish to point out that, besides the material good resulting from it, there is to be considered the moral improvement it effects. In all human beings there are certain gregarious instincts, more particularly among the young ; and it is very desirable, therefore, that when they do congregate it should be for good and not evil purposes. It is well that the outlet for their superfluous energy should be directed into safe and harmless channels ; and what way can there be safer or more harmless than that, after they have sorely wearied their brains with geography, history, arithmetic, etc., they should have opportunities and facilities afforded them of seeking the variety and change of occupation so necessary to the mind and body, for rousing to action the faculties, mental and physical, that have lain dormant for hours, and, forgetting the troubles, trials, and anxieties that in a greater or lesser degree fall to the lot of one and all, be enabled to throw themselves heart and

soul into some joyous healthy game? Depend upon it, that many rough lads of the corner-boy class, who are now but too frequently guilty of acts of disorder and violence in the public streets, if they only had the chance of playing, and knew how to play, good vigorous games, would often be kept out of mischief thereby; and the manly instincts, the spirit of fair play engendered in those who take part in athletic pastimes, would quickly produce a humanizing effect upon them, to the lasting benefit of their souls and bodies. The grand virtue of temperance also is undoubtedly fostered in those who strive to excel in manly games; for no one can hope to become an expert 'gymnast, or a good football-player, or a cricketer, or whatever it may be, who is self-indulgent or intemperate in any way. His life must be moderate, and he must exercise great self-control, if he aspires to get the better of his companions in the friendly rivalry of an athletic competition of any kind. His nerves must be braced, his wind must be sound and good, his sinews must be tough and strong—in short, he must be in "condition," before he can hope to hold his own in any manly contests; and temperance, in every acceptation of the word, is the one absolute essential to ensure success. There are, I am well aware, many good and philanthropic men and women in these days who are spending much time

and energy and vast sums of money in organizing clubs, and in providing open spaces or well-lighted suitable rooms for recreative purposes—and a great work it is that they are engaged in; but the large majority of well-to-do and affluent people appear to me to utterly fail to realize the supreme importance of these places as a means of promoting both the physical and the moral well-being of the youths of our working classes in great towns and cities, even if they ever give the subject a thought, which I doubt; and they most certainly seem to ignore it as being an element of great value in the education and formation of the national character. I am most anxious not to be misunderstood, and I do not wish you to imagine for an instant that I underrate the value of mental education in these days of keen, nay, desperate competition. It is because I do appreciate to the full of what moment it is to a man or to a woman to be *thoroughly* educated, that I thus plead for the due cultivation of their corporeal faculties. The mind should, without question, be so exercised as to ensure its full development and power being attained; but there must be a pause at that stage where over-fatigue commences, and rest in the form of recreation must be given it, or it will deteriorate in health and vigour; and let not any one suppose that because he or she is training for a sedentary life—that because he or she is to be a barrister,

chemist, printer, clerk, sempstress, washerwoman, or whatever it may be—that therefore his or her physical qualifications are of secondary importance.

I tell you that men and women following the everyday peaceful avocations of the ordinary citizen are as frequently called upon to undergo a serious trial of patient endurance and suffering as are soldiers, or sailors, or firemen; and but too many of them, alas! break down and fail with their life's task but half accomplished, simply for the want of the requisite stamina, which they might have possessed if only, in the course of their general education, the right measure of physical training had been meted out.

We Englishmen of the present day have had handed down to us a glorious and a priceless heritage in the great empire over which our beloved sovereign now reigns; but remember it is an entailed inheritance, and one to be held and defended against all claimants. And as we hold it in "trust" for those yet unborn, not only must we keep it intact, but we must improve and expand it; and as it was won and consolidated for us by the stout hearts and strong limbs of our forefathers, so by our own stout hearts and strong limbs, and by that of our descendants, can it alone be protected and maintained, now and in the future.

The proper cultivation of our physical powers is

imperative, to enable us to undergo the trials and hardships of the arduous campaign we are all engaged in, to prepare us to manfully fight the battle of life, taxing, as it too often does, all our moral, mental, and bodily endurance to their extreme limit; and you may rely upon it, that when the day of fierce conflict with the troubles and anxieties of this life comes—as it does come to most of us—the man in whose person is combined the sound mind and sound body is the man who stands the best chance of conquering and overcoming all difficulties.

It is, therefore, our bounden duty to prepare ourselves for this fight by cultivating our moral, our mental, and our physical faculties to the utmost; and any system of education which has not this as its guiding principle is an unsound and faulty one. It is a duty we owe to God, Whose temple our body is; a duty we owe to our neighbours, and those dependent on us for maintenance, protection, and support; it is a duty we owe to ourselves, if we wish to enjoy happiness and longevity; it is a duty we owe to our Queen and country, if we desire to promote, sustain, and develop the commerce, wealth, and power of this the greatest empire that has ever existed on earth; in short, it is our duty—let us do it.

HAND-AND-EYE TRAINING

BEING A

DEVELOPMENT OF THE HANDWORK OF THE KINDERGARTEN FOR JUNIOR AND SENIOR SCHOLARS

BY

GEORGE RICKS

HAND-AND-EYE TRAINING

FOR years past some of the shrewdest men in England have seen that our public elementary school system has certain fatal blemishes, and some of the most keen-sighted of all declare roundly that it is a sorrowful failure. Men of the world tell us that we make our young people fatten too much on books; that the traditions of the cloister cling to us still, and that most of our scholars are but little better off than the poor souls who were fed on the "ancient tongues and godly learning" in the monkish schools long ago.

Head-masters of higher schools, into which the pick of our pupils pass, tell us that we are turning out mere machines. Our "fancy" boys and girls —the crammer's pride—can neither observe nor think; they are phenomenally accurate within certain narrow limits, but their powers of independent thought are atrophied; they have not the alertness which marks the true mental gymnast, and their intellectual interest is entirely subdued.

The skilled workers, the teachers, tell us that we try to make unhappy little ones digest ugly quantities of educational sawdust for the purpose

of manufacturing safe "passes." "A home of cram," says one, "a warehouse of barren facts and figures, but void of things beautiful or imaginative," is our typical elementary school.

Neither are Her Majesty's Inspectors behindhand in adding to the mournful tale. Children are taught to read, but no taste for reading is acquired; arithmetic consists of tricks and dodges instead of simple processes of reasoning; object-lessons exist but in name; and, in brief, so engrossed is the commonplace teacher with the financial outcome of every item of school work, that a scholar may pass through all the standards, and yet leave school "unintelligent and illiterate," and in no sense equipped to fight the battle of life.

Such is the heavy indictment brought against our public elementary school system. I admit that some of our critics are perhaps hypercritical, and that some of their remarks savour of cynicism; yet I am bound to say that, in the main, the indictment can be substantiated. No doubt many teachers have the faith to believe, and the courage to act on their conviction, that intelligent training all the year through pays better, even under the present stereotyped system, than the more mechanical work in examination grooves; and on these, strictures of the kind I have indicated sit but lightly. Yet the fact remains, as pointed out in Mr. Bousfield's able report, that "the mental or

brain work, which occupies the great bulk of the time in all schools, is composed far too much of appeals to the memory only, resulting at the best in the retention in the child's mind of a mass of undigested facts; and far too little of the cultivation of intelligence, and the awakening of the reasoning faculties." Moreover, the report adds that "the physical or bodily side of education (including the development of muscular strength, of the accuracy and of the sense of colour, and of proportion of the eye, and of the pliancy and dexterity of the hand) is almost entirely neglected."

And we have not far to seek for the cause of this unsatisfactory state of things. It lies in the system, and is inseparable from it. Our public elementary school system is not educational, but financial. The main purpose for which the education department exists is to distribute money from the public exchequer, and the chief duty of Her Majesty's Inspectors is to dole out these grants in proportion to the amount of knowledge, digested or undigested, the teacher can demonstrate he has packed into the children's minds, irrespective of ability or opportunity. And so long as the success of the teacher is judged by the amount of money he can earn; or, which is the same thing, by the "percentage" he can secure, so long will he consider it his paramount duty to manufacture safe passes. If the sham article is the desideratum, it

is but natural that the sham article should be produced. One of the most successful of the head teachers under the London Board remarked to me the other day, that his large classes of Standards VI. and VII. had just passed a brilliant examination. "They came to the post," he said, "as fit as preparation could make them. But," he added, "I am ashamed to confess it, I could not guarantee that a single one of them would pass the same examination if tested again three months hence."

One of Her Majesty's Inspectors remarks, in his report in the Blue-book, that "the teacher is apt to forget that his main duty is to develop the higher faculties of his scholars, not to prepare them to earn grants or to swell the percentage of passes." Quite a mistake; the teacher does not forget. He may look longingly on, but necessity compels him to pass by on the other side.

I wonder what would be the result if, in the district where this Inspector reigns supreme, a teacher forgot all about passes and percentages, organized his school for the good of his scholars, and strove with might and main to "promote that harmonious development of all the faculties—mental, moral, and physical—with which the child by nature is endowed," which is described in Mr. Bousfield's report as the object of true education. If he were a man of exceptional powers, he might possibly pass muster on the examination day; but

otherwise, I fear he would soon find himself and his family homeless, and his children begging their bread.

If our elementary school system in practice shuts out what is highest and best in education, if it tends to encourage methods inconsistent with true mental training, if it fails to promote that harmonious development of all the child's faculties to which I have already alluded, it fails in its main purpose, and needs radical alteration.

Mr. Mundella, at a meeting held in the Hall of the Society of Arts in November, 1889, struck the key-note, when he said it must be *recast.* And it must be recast on educational, not financial, lines. I am not for one moment suggesting that the people of this country will ever agree, or ought ever to agree, to spend six or seven millions a year on education, and not take every possible care to see that the money is properly expended. On the contrary, I care not how much supervision there may be, or how frequent the inspections and examinations. What I do care for is that education shall no longer be subsidiary to finance. Pay what is necessary fairly and evenly according to circumstances, and see that the education is given. Should failure occur, remodel the machinery; but don't take away the fuel which drives it, and without which it is impossible to produce the required results.

If I refer again to Mr. Bousfield's report, it is because in it you will find shadowed forth the answer to the all-important question—how to make our boys' and girls' schools fill the full measure of their opportunities in developing and training all the faculties of the child, both of mind and body. In my judgment, the solution lies in the extended use of the Kindergarten principles, and in the introduction of advanced Kindergarten occupations. The first will largely substitute mental training for memory work, and intelligent teaching for clever cram; the latter will provide that special training of hand and eye hitherto almost entirely neglected in our schools.

And if I were compelled to sum up Mr. Bousfield's report in a few words, I should say that its first and great commandment is Kindergarten *principles;* and the second is like unto it, viz. Kindergarten *practice.*

What is the Kindergarten? The literal translation of the word is "childgarden;" but figuratively it means an educational garden—a school in which all the budding faculties of the child are tended with the same loving care, the same assiduous attention, and the same skilful guidance as are the flowers in the beautiful garden of an enthusiast in floriculture. Its leading principles, as set forth by Fröbel and his followers, are, that all education should begin with the desire for

activity innate in the child; that a knowledge of things can be best obtained from things; that the best method of learning is by doing; that the teacher's mind must come down to the level of the child's mind, entering into it as it were, for the purpose of guiding and leading him to learn, and exciting his interest till he wishes to learn for himself. It is an inward system of direction and development, intent not upon giving in, but upon drawing out. Further, it aims at manual dexterity, and love of active work, no less than in awakening and directing intelligence. Fröbel is never weary of repeating that man must not only *know*, but *produce*; not only *think*, but *work;* and that the capacity for work must be trained in early childhood in conjunction with the observing and apprehending faculty. The hand should be no less dexterous and the eye no less accurate than the judgment is sure. [It would, of course, be superfluous for me to stop to describe the practice of Kindergarten to an audience of managers of London Board Schools.]

Fröbel worked out his ideas for the infant-school stage only; he has left it to us to develop and extend the occupations, and to find the application of his principles for children of larger growth. Experts are pretty well agreed that the introduction of the Kindergarten has completely revolutionized the modern infant school. The teaching

is more natural, the school more attractive, and the education of a higher calibre altogether. If you study the latest Blue-books, you will find a general consensus of opinion among Her Majesty's Inspectors that the infant school, with its varied occupations, is "the most satisfactory part of our educational system," and a general desire is expressed that the happy mixture of mental work, of hand-work, and of organized play of the infant department should be continued in the senior departments. Let me cite two or three opinions. Mr. Coward, after stating that he was one of the many who regarded the introduction of the Kindergarten with sceptical eyes, says, "The manual exercises in which the children are trained furnish an interesting and delightful diversion from the ordinary school work, and at the same time educate hand, eye, and mind. Drawing, embroidering, mat-weaving, moulding in clay, if properly taught, are invaluable instruments for developing at once the mental and physical faculties. And, in view of our new departure in the direction of technical education, they should be cultivated as part of its best foundation. The infant school in which the system has taken firm hold is a home of learning made attractive, of pleasant hours spent usefully in the acquisition of habits that may be of lifelong value. I only wish we could continue in the first and second standards the same training.

But, alas! the children who leave the infants' schools for the older departments part, I fear it must be said for ever, with all these special advantages. They pass into the dreary routine of endless repetitions, of dull spellings, of readings without interest, of dry numbers without illustration, and they soon lose their brightness and interest in learning." Mr. H. Harrison reports, "The most satisfactory feature in the code of 1883 was the impetus it gave to the general introduction of the Kindergarten principles, and such occupations as have for their object the training of eye and hand, and the cultivation of the faculties of observation. The improvement in our infants' schools has been most marked. The old infant school of ten years ago, with provision on its time-table for little more than the rudiments, is now hardly to be found; the children are brighter and happier, and far better advanced, even in the rudiments, because they are not wearied with them." Mr. Brewer says, "A really good modern infant school, with its cheerful room, its comfortable furniture, its prettily adorned walls, its interesting occupations, and its happy occupants, makes one feel that he is in truth in a Kindergarten, a garden of little ones." Mr. Sharp writes, "In spite of apathy and opposition, Fröbel's system, which engages the co-operation of all the class through common sympathy and through natural methods, is gradually pervading the infant

school, and must soon be extended at least to the lower classes of the other departments. Young children go back in intelligence when they are transferred to the upper school from the well-taught upper classes of an infant school. In the latter the observation is cultivated by the exhibition and variety of interesting objects and natural phenomena ; manual dexterity of hand is trained by careful manipulation of delicate processes ; distinctness of vision, and power of using the eye, are produced by careful drawing ; simple directness of thought and language are cultivated. A bright scholar leaves all these and passes into the upper school, where, not unfrequently, he falls into a dull routine of mechanical reading and arithmetic, the only relief to this unnatural tension of mind being the exhibition of a few geographical diagrams and pictures." Mr. Wix reports, "The bright faces of the children, the happy mixture of work and play, the interesting and well-illustrated lessons, all make it apparent that a living machine is at work well adapted to the end in view." Of the Kindergarten practice he says, "I greatly approve of it, and I wish that some occupation requiring manual skill could always form a part of the education of the elder children." I could multiply such quotations. I shall add but one more, and that from Mr. Legard, of the Leeds district. He says, "I should like to see the methods of Kindergarten teaching

in infant schools developed for senior scholars throughout, so as to supply a graduated course of manual training in connection with science-teaching and object-lessons." I need not remind you that these words are taken from Mr. Bousfield's report.

So much for the beneficial influence of the Kindergarten methods and practice on the infant school. And now I want to ask, "Is there any valid reason why the same beneficent influence should not be allowed to brighten and elevate the work of the senior departments?" There should be absolutely none. I am quite aware that I shall be met with objections. I shall hear, "How can we find time for it?" "What subject must make way for it?" "Who shall teach it?" and so on. I confess these objections trouble me but little. I have a vivid recollection of the same sort of objections being raised years ago on the introduction of class subjects, and more recently of drawing and of Swedish drill; but, somehow or other, these have all shaken down into their proper places, and who will declare that the schools are the worse? If it is necessary that the hand and eye should be trained as well as the mind, and there is not room for it in the present time-table, then some less important subject must make way for it. It is not at all a question of room; the real question is, "What

subjects deserve the first consideration, or what subjects are most likely to be conducive to the child's future welfare?" No doubt it is a fact that by far too much time is taken up with monotonous spellings and unprofitable parsing, and that the time given to fine needlework may with advantage be curtailed; yet I don't propose to substitute the training of hand and eye for either the one or the other of these. I believe with Dr. Fitch that "the withdrawal of some hours of the week for varied manual occupations, so far from diminishing the chance of progress in the ordinary departments of school instruction, has actually had the effect of accelerating that progress by means of the general quickening of intelligence, and the increase of power developed." My firm conviction is that, by alternating to some extent hand-work with head-work, we shall secure all the advantages of hand-work without detracting one jot from the efficiency of head-work.

It is usual to classify the exercises of the various plays of the Kindergarten into forms of knowledge, forms of life, and forms of beauty. The first refers to the more purely mental exercise of geometry and number, the second to the construction of familiar objects, and the third to design. We may call the first *head-work*, and the second and third together *hand-work*. I am aware that this classification is unsound, because the former

includes much eye-work, if not much hand-work, and in the latter the observation and intelligence of the children are at work no less than their hands. But the division will serve my purpose.

I am not proposing on this occasion to consider the application of the principles of the Kindergarten teaching through concrete forms to the teaching of reading, arithmetic, geography, elementary science, and so on. The method is as old as the hills; the practice, in a vast number of schools, is as rare as the snow in summer. I shall omit this more important branch, the head-work, and confine my remarks to the less important branch—the hand-and-eye training.

It may be convenient to call this manual training; but we must be very careful to clearly distinguish between this Kindergarten manual training, and what is generally known as technical education. At present much confusion exists.

Public opinion has, within very recent days, decided emphatically that something must be done in the way of manual training, or technical education, or technical training; but we have to search far and wide to pick up a lucid and definite notion on the subject. Most people have a hazy idea that it has something to do with the factory and the workshop, and that it will enable us to cripple and crush intrusive foreign competitors in the commercial world with punc-

tuality and despatch. Beyond that, the notions of many an enthusiastic supporter of manual work do not travel. Let me say at once, that special or trade instruction under the name of technical education cannot, and ought not, to find a place in the primary school. The manual training on Kindergarten lines is quite a different thing. It is a combination of head-work and hand-work, calculated, in the first place, to assist materially in developing the mental faculties; and, in the second place, to bring about such skill in the use of the hand and eye as will enable the learner more quickly, more easily, and more intelligently to learn any art or handicraft hereafter in which the use of these organs plays a prominent part. Technical training is special training for an industrial pursuit; manual training is a general preparation for any calling hereafter to be chosen.

The advocates of manual training, as I have already pointed out, base its claims on its industrial rather than on its educational utility. "Let us study the good of the individual workman in particular," they say, "and through him the advantage of the nation at large; let us reduce the plethora of unskilled labour, and we shall be enabled as a nation successfully to compete in arts, in manufactures and in commerce with the rest of the world." Educationalists take a higher view. They

assert that education is incomplete without the proper discipline of the hand and eye. They say, "Education based mainly on book-work and oral instruction is incomplete; it needs the hand-and-eye training to round off and perfect it. The training of the faculties is the primary object of education; and, although it is a mistake to suppose that book-knowledge does little to develop the powers of mind, it is equally a mistake to suppose that book-knowledge alone will suffice. An ideal education is one which multiplies the power of the eye to see, of the ear to hear, of the hand to execute; which puts a mind well stored with knowledge into active contact with faculties capable of translating it into action. The hand, the eye, and the ear must be as carefully trained as the mind, and the system of education which confines itself too exclusively to either the external or the internal man is one-sided, and therefore defective. Mind and body must be so correlated, that their highest development can only be effected through that system of training which makes the most of both." Undoubtedly this higher view is the correct one for us to take of manual training. It must form a part and parcel of the general education, just as much as reading or arithmetic, and it must be an education of the mind as well as the eye, of the morals as well as the hand.

I should like to dwell for a minute or two on

this educational aspect of manual training. What is the essence of true education? Is it not the gradual growth of the power of thought under skilful cultivation, the development of ability to acquire knowledge? Now, there can be no thought without the material to think about. And how is this material to be gathered, but by observation? The first step in true education must be to develop and train the power and habit of observation. With all our knowledge of words, very few people seem to know what observation means, and they certainly know little of its amazing powers. It produces new growth, and new kinds of growth in the mental organism, just as a gardener produces new growths and new varieties of plants in the garden. Says Rousseau, "It is the right cultivation or the repression of inquisitive observation that makes children expert or stupid, sprightly or dull, sensible or foolish." Of trained observation, Professor Huxley says, "The method of observation and experiment by which such great results are obtained in science is identically the same as that which is employed by every one every day of his life, only refined and rendered more precise." You have all of you heard, I dare say, of the tale of the gamekeeper and the gentleman from town. They walk through the fields, chatting as they go. Suddenly the man of velveteens whispers, "Look, there's a hare on her form!" The novice stares,

and asks, "Where?" "There," says his friend, pointing to a tuft of grass a few yards ahead. The novice looks in vain, and all the while he might possibly hit puss with his stick if he threw it. They take a dozen strides, when up starts the hare, and, before the novice has recovered from his surprise, is lost to view. Both of these men have the same image of the field depicted on the retina, yet one sees, and the other sees not. And so it is generally; the majority of the people in the world go through it with eyes open, but they see not. And why? Just because their powers of observation have not been developed. But what has all this got to do with manual training? you will say. Just this, that nothing can stimulate and strengthen the habit of precise observation so much as doing things. To do a thing is to know it. Or, as Comenius says, "things are best learned by doing them." Set a child, for example, to model an acorn in clay, and however awkward his first attempt may be, his ideas of the shape and beauty of form of the acorn and its cup will be ten times clearer and more definite than from any amount of verbal description, or even of eye observation only. As a help, then, to accurate observation, manual training is a help to mental development.

Closely allied to the faculty of observation is the faculty of attention. The young have little power

of attention. The power has to be acquired; and I am afraid this fact is too often forgotten, and that teachers expect and require too much from young children by way of attention. This by the way. What I really want to point out is that hand-work and eye-work exercise an immense influence in forming and strengthening this invaluable habit of attention. And this strong and subtle influence is exerted in the most pleasant and attractive kind of way. To draw, for instance, on a sheet of card-board the plan to form a square pyramid, to cut precisely to the lines, to fold exactly, to glue up, and, if necessary, to bind, require a considerable amount of attention. But, then, the work to children is so fascinating that the attention is easy and unstrained—admirably fitted to form the habit. Manual operations demand the whole attention. There is no opportunity for the wits to go wool-gathering. Directly the attention wanders from the task the child becomes aware of it, because his work is damaged or spoiled.

Observation has yet another brother in accuracy. "The excellence common to all trained workers," wrote the late Mr. Thring, "is accuracy. Observation and accuracy are twins. The beginning of all true work is accurate observation, the end and crown of all true work is an accuracy which observes everything." And what work is better suited to the training to this accuracy than hand-and-eye work?

The mental side of manual training, then, is represented by its special power to develop and stimulate habits of observation, attention, and accuracy.

I need not remind you how hand-work is a training in the virtues of diligence and perseverance, of order, neatness, and carefulness; but I must just refer to one other point—the effect of manual training on the dull boy. "The use of tools is good for the bookish boy to draw him away from his books; but, in a greater degree, is it good for the non-bookish boy, in that it may show him there is a possible something he can do well. The boy who lacks the natural aptitude to keep pace with his schoolfellows is apt to lose heart altogether when he feels his inferiority in the matter of book-learning; but put him in the work-room, and let him discover that he can do a piece of hand-work as well or better than his more highly favoured compeers in brain-work, and you have given him an impulse towards self-respect and manly self-reliance which will prove of great benefit to him when he returns to his books."

It cannot be too clearly or too forcibly expressed that the essence of manual training lies not in its attractiveness, though that is something, nor in its resultant specimens, however pretty or useful. The main good lies *in the effect produced on the child* in developing powers of mind and body. In a word,

the discipline of the doing is the cardinal point; all other claims must be subsidiary.

The occupations which I propose as the basis of hand-and-eye training are either developed from, or founded on, the Kindergarten plays. Drawing is the foundation, and an integral part of the whole. Drawing is a manual training in itself. It is an educator of both eye and hand. The eye is rendered incomparably more accurate, and the hand is brought more completely under the power of the will than by any other exercise whatever. But, then, as an American writer puts it, drawing in itself is not sufficient; it must be supplemented by its application to work in paper, cardboard, wood, clay, or other material. Manual training through drawing alone is work but half done, and the other half—that by which material is shaped into any preconceived design represented by drawing—has hitherto been entirely wanting in our schools. Unless the element of construction is added, drawing must fail to yield the full measure of good expected from it. Designing, and the working out of the design, are but parts of one whole; neither can have full educational value without the other. Drawing and applied drawing must be inseparably connected and woven together.

It would manifestly be impossible for me to explain the proposed occupations in sufficient detail for the explanation to be of any effective

service. I shall therefore content myself with doing little more than name them.

The *first* occupation consists in folding paper—plain and coloured—in various ways to produce geometrical forms and patterns similar to the designs produced in the Kindergarten drawing. These are cut out with scissors, and the simpler forms are recombined into other and more elaborate patterns and designs, and mounted on stiff paper, or cardboard.

The *second* occupation is similar to the first in all respects except that the cutting lines are produced by drawing instead of by folding. In this occupation both the plain and coloured paper is cross-lined or checkered, as in the Kindergarten drawing-books. Perhaps the best method of practising children in the formation and invention of patterns is to take a stout paper, or even thin cardboard, from which to cut the fundamental forms. These may be laid out and pinned on to a piece of millboard or a small drawing-board. In this way new combinations may be formed just as the fancy or ingenuity of the pupils may suggest.

The various manipulations of these two occupations should develop considerable skill and accuracy, and the dexterity acquired should prove of considerable value in the various exercises of needlework, and in the folding, cutting, and fitting the many necessary articles of clothing. Some-

thing, too, will have been done towards developing a taste in colour and arrangement.

In the *third* occupation the forms and the cutting lines are produced by both folding and drawing. From the two fundamental triangles of the Kindergarten we derive an almost endless variety of patterns, which in their turn open up an immense field for the exercise of the inventive faculties.

The *fourth* occupation is an advance on the second, for here we call into requisition the compass and the set square. It is but a preliminary to the next occupation, viz. modelling in cardboard.

The *fifth* occupation, modelling in cardboard, is perhaps the most interesting and effective occupation, especially for the elder girls. The specimens speak for themselves.

The *sixth* occupation, viz. drawing, colouring, and designing, has a twofold object—to develop the Kindergarten drawing of elementary forms into more advanced work in design, and to give practice in the application of colour, and to teach the simple principles underlying their use. This work is entirely independent of the other occupations, and may be taken through all the classes in a school; but it answers less well than either of the others to the generally conceived idea of manual training. It has the advantage, however, of adding next to nothing to the expense usually incurred in the

teaching of elementary drawing, and it is an excellent means of cultivating the artistic taste.

Modelling in clay is the *seventh* occupation; and by modelling in clay as a means of hand-and-eye training, I mean just such handling of the substance by little children as will best cultivate habits of accurate observation, neatness, cleanliness, hand-dexterity, and artistic taste. Children are fond of representing objects by lines, but to make the things themselves has a fascination much greater. Besides, modelling is easier than drawing. "In drawing," says Mr. Ablett, "the apparent form is shown by using lines in a more or less conventional way which is somewhat puzzling. With plastic material the length, breadth, and thickness of the object may be exactly reproduced. And it has this advantage, too, that something tangible is the outcome of the child's efforts." Objections have been raised to this occupation because "it is so much trouble," or "it is dirty work." Certainly it is a trouble; but what work is there worth doing which is not a trouble? As to its being dirty work, I deny it. What is dirt? Some one has said, "matter in the wrong place." But this is matter in the right place. But suppose it is dirty; what then? Is all the work in the world clean work? And have we not here an excellent means of inculcating important moral lessons? True it is that bits of clay will stick to the fingers

and to the little pinafores; but from this may we not learn that the soiled blouse of the artisan, or the horny hand of the peasant, supply us only with the key to the man's daily occupation, not to his inward worth. The educational value of modelling far more than compensates for its slight disadvantages. It is the best method of training the observing faculties, and it is the best language of form we possess.

The *eighth* occupation, viz. drawing plans and elevations of forms constructed of Kindergarten material, is a preliminary to the *ninth* and last, viz. "bench-work" in wood, or "slöjd." The Swedish slöjd, as you are doubtless aware, is a scheme of training in the use of cutting tools; wood being the material used. The system is constructed on definite principles, with a view to a distinct educational training. It is but seldom, however, that a plant transferred from its native soil will at once take root and flourish in a foreign clime. And so it is with slöjd. Admirable as it undoubtedly is in the country of its origin, it requires some modification to bring it into conformity with English notions and English tastes. There is one point in particular in which slöjd contravenes a most important principle which I have laid down for manual training, viz. that drawing, including design, must form the groundwork and guide throughout. In slöjd the pupils copy from

wooden models, and, if drawing is introduced at all, it is only as a substitute for the model. There are no working drawings, and of course no working to scale. I have said that in my judgment designing and the carrying out of the design should form but parts of one whole. Slöjd confines itself to the carrying out of the design ; the design being the work of the teacher, not the pupil. Now, while I fully acknowledge the educational value of slöjd, I maintain that its value would be immensely enhanced if it were more intimately connected with the teaching of drawing and design. At present the pupil has little room for originality, and his imagination is confined within the narrow limits of a series of wooden models. Let me not be misunderstood. I am entirely in favour of slöjd. I believe no good scheme for this work can be made except on slöjd principles. What I do say is, it requires amendment in the way of working to scale from drawings, and the models need to be adapted to English tastes.

In conclusion, let me say that I am anxious that you should understand that I do not advocate the placing of "hand-work" on the same pedestal as "brain-work." Mental training must always be the main consideration. Hand-work must ever remain content to act as the humble handmaid to head-work. My contention is, that hand-and-eye training must receive the consideration due

to it, first for its own sake, and secondly for its help to mental training.

There are some other important, if secondary, advantages to be derived from manual training.

First with regard to the school. There is at present too much mental work in our schools; the faculty of attention is too much strained, and hand-work will be a relief. It will come as a "boon and a blessing" to little weary brains. Thus will it tend to make the schools more attractive, and the attendance more regular. And it will do something towards removing the stigma applied by a prominent teacher to the typical elementary school, that "it is a prison-house entered rebelliously, and quitted for ever with turbulent joy and singing."

Then with regard to the children themselves. Manual work should not only train the artistic faculties and inspire a taste for work with the hands, but it should develop an aptitude which must prove of the greatest benefit in all practical life.

The most obvious of the ulterior benefits to be derived from manual training is its tendency to foster skilled labour. Then, as a necessary corollary, it must advance the material welfare of the nation as a whole. Furthermore, and this refers particularly to the girls, it cannot but exercise the greatest beneficial influence on the order, neatness,

and comfort of the home. We want our girls to leave school with well-trained hands and eyes; we want them interested in design, and with a taste for neatness and arrangement. We want their minds imbued with a love for all things beautiful, whether in form or colour. All of which endowments will naturally produce an improvement in taste, which in numberless ways can be made to brighten and beautify the home.

EVENINGS OF AMUSEMENT FOR BOARD SCHOOL CHILDREN

BY

ADA HEATHER-BIGG

EVENINGS OF AMUSEMENT.

I.

WHY THEY ARE NEEDED.

"CHEERFULNESS or joyousness," says a great German writer, "is the heaven under which everything but poison thrives." This, though put poetically, is really the enunciation of a great truth. Every hour of happiness which we manage to secure, provided in securing it we neglect no duties and inflict no injury on others, is a distinct gain both to ourselves and to others.

Physiologically, happiness heightens vitality; and since, whatever increases vitality, increases our power of being of service to mankind, it follows that, the more happy people there are in the world, the better it is for the world. In short, that there is an hygienic aspect of happiness is practically admitted by every one who considers the subject.

"Happiness is the most powerful of tonics," says Herbert Spencer; and Romanes, in an excellent

article of his on "Recreation," declares that "a prolonged flow of happy feelings" does more "to brace up the system for work than any other influence operating for a similar length of time."

In a less degree, too, doctors constantly bear testimony to this fact, when they dwell on the value of cheerfulness at meal-times, and point out that healthy digestion gets promoted, if at those moments we dismiss care, and deal only in fun and laughter.

And he was not altogether unversed in the healing art who counselled a gloomy dyspeptic patient who had consulted him for confirmed melancholy, to go and see one of our great comedians. Unfortunately the prescription was an impossible one, because the dyspeptic sufferer happened to be precisely the great comedian himself; but this little difficulty in no way interfered with the excellence of the medical theory which underlay this recommendation.

Undoubtedly that greatest of the Italians, Dante, showed profound insight, alike as poet and psychologist, when he wrote those memorable lines—

"No greater grief
Than, in the time of woe, past joyaunce to recall."

But the physiologist would tell you that men and women who have had their fill of quiet happiness in the past, are better fitted to bear up under suffering, when it comes to them, than the human

being who from his cradle has been borne down by a lifelong load of dulness and depression; just as a man with a fine sound constitution can survive injuries which would crush the life out of a more sickly person.

On happiness as a health-giving medium, then, there is no need to enlarge, and it may safely be affirmed that if the attempt to provide amusement for our school-children were made with no other aim than that of promoting their happiness, it would still be a highly judicious form of philanthropic endeavour.

At the same time, there is force in the objection, that before individual School Board members, managers, and the teaching staff generally, can with any show of reason be asked to interest themselves in a scheme of amusement which shall be coextensive with elementary education itself, something more must be proved than the hygienic value of happiness. Vaccination is considered by a vast majority of people to be of the utmost importance, but they do not on that account hold that the Board should lend its schools as centres for vaccination. The question will naturally arise, What are the further specific advantages which accrue from grafting a scheme of amusement on to our system of Board School education?

It is precisely to answer this question that the present paper is written.

What I would wish to show is, that amusement rightly understood is one side of education, and that it is, therefore, the proper concern of all who are assisting in the work of national education.

To quote Richter again, "The early blossoms of gladness are not corn-flowers among the seed, but are themselves tiny ears of corn."

The well-to-do classes, in their methods of bringing up their children, recognize this truth very fully, since they make as careful provision for recreation as for education. Look at the way in which, in the big public schools of England, athletics form an integral part of the whole educational curriculum. Look, too, at the football, cricketing, bicycling, and boating clubs connected with even our most ordinary schools and colleges. Look, too, at the advertisements for tutors, which one sometimes sees in the daily papers, where an anxious parent, after enumerating the intellectual attributes he hopes to find in his son's mentor, and making express stipulation as to character, adds these significant words, "Preference given to a good football-player."

If it were only physical exercise that was aimed at, drill, gymnastics, and constitutionals would be all-sufficing. But games which involve physical exercise *plus* pleasure are infinitely preferred by the educator.

They are preferred, not merely because of the

superadded effect on health which the pleasurable element induces, but for the further reason, that, in the self-abandonment of enjoyment, barriers of awe and reserve go down, and children, revealing all the idiosyncrasies of their disposition, become more plastic material for the educator's influencing efforts.

It is because the personal influence of refinement of manner and elevation of thought can make itself more effectually felt in the hours devoted to play than in those absorbed by study—because, too, the character of the adult can be brought into more *absolute* contact with the impressionable nature of the young, when all alike, equal and happy, are engaged in one common diversion—that properly directed recreation has come to have such value in the eyes of the upper-class educator.

But if recreation, and especially physical recreation, be deemed so necessary for the children of the well-to-do classes, it is clear that there can be no good reason, apart from the difficulty of obtaining it, to prevent it from being considered equally essential to the children of all classes. If it adds to happiness and health, and enables good influences to have their way with the child of the rich, so to a greater extent even is it capable of serving the same purpose with the children of the poor.

That is why some of us are so anxious to

establish evenings of amusement and healthy play for the children in our schools, and to give to this scheme of influence and happiness the continuity and coherence which belong to all schemes resting upon Board School organization. For really, as the Rev. Donald Trewby says, with some force, "there is no reason why any girl should pass beyond the region of active good influence, if only people work on a system and all together." In the future, perhaps, it may even be found possible to unite all the different agencies for helping girls and young women, and boys and young lads, on this foundation of the higher standards in our Board Schools.

The great thing, however, is to begin early enough. For, unfortunately, we cannot be blind to the fact that too many workers among the poor postpone their attempts to improve the condition of the masses till the really fruitful moment has gone by. Then they will complain of the failure of their efforts, and ascribe it to the inherent difficulties of their task, whereas they ought frankly to recognize that it is their method of attacking the problem which has been in fault.

As I have said elsewhere, "We go among the poor, preaching temperance, thrift, and independence, and the people at whom we level our sermons have already acquired a taste for drink, have fallen into shiftless hand-to-mouth ways, and

have habituated themselves to accept without shame the pauperizing gifts of irresponsible charity, or to look to the legislature for everything which they should achieve by their own exertions. Did we concentrate our efforts on influencing the lads and lasses of our industrial classes, and could we but maintain that influence till the period of adolescence, we might safely leave to themselves the task of keeping for the future in the good grooves of worthy citizenship."

In short, it is the merest folly to attempt to reform adults, so long as there are children in our midst who, by good influences, can have their natures developed above the *need* of reform.

I read in a recently published book on our colonial empire the other day, that in Australia the great majority of neglected or criminal children who are caught by the state *before* sixteen are saved, but those who are left to pass that age are almost hopeless.[1] Well, it is not only in Australia that such a statement holds good.

From ten to eighteen, I consider, are the years when our labours of good influence and amusement should be most strenuous and unremitting—and from ten to thirteen most particularly. But for children of this earlier age, provision of the kind indicated, so far as the Board Schools are

[1] "Problems of Greater Britain," by the Right Hon. Sir Charles Wentworth Dilke, Bart.

concerned, has been wholly lacking, while, so far as other agencies are concerned, it has been miserably inadequate.

Yet it is notorious that the children of the very poor go out into the industrial world before they are thirteen, that at thirteen they are earning wages as full-timers, and that the tendency to employ them in preference to adults is on the increase. Thus the bonds of home life are loosened, the associations of school completely severed, and every day subjects the young girl to new, to powerful, and, alas! too often to deteriorating influences, and renders her less susceptible to good influences, when later on these are again brought to bear on her.[1]

That is why it seems so vital that managers should turn their thoughts to this matter, duly

[1] If a girl, after she has left her school, is encouraged still to keep up her association with it by continuing for a time her attendance at these Children's Happy Evenings, the influence of her teachers and of the ladies who work these evenings will go on without a break, and can be supplemented later on by the equally good influence of those who conduct the Recreative Evening Schools Association Classes, Girls' Evening Homes, Clubs, and the like. In this way there will not be that interval of three or four years coincident with the girl's entry into industrial life, during which she is more or less cut off from the old influences without being subjected to the new. At present there is declared to be an increasing number of children under the age of thirteen reaching the exemption standard, while in too many instances the age of admission into girls' clubs is sixteen. In one well-known girls' club I ascertained that only four out of two hundred and thirty girls were as young as thirteen.

remembering that, by Article 146 of the Code of Regulations for their guidance, they are expressly told that they are to have at heart the mental, moral, and physical welfare of the scholars, and to see that there is impressed upon the child the importance of cheerful obedience to duty, of consideration and respect for others, and of honour and truthfulness in word and act.

Amusing the school-children, if only those who amuse are worthy of their office, and blend influence with amusement, is precisely carrying out these instructions of the code.

For in the perfect freedom of play there can most readily be engendered that quick sense of justice, that hatred of mean trickiness, that respect for truth, and that regard for the feelings of others, which are the very soul of good citizenship in after-life.

To assist, then, in the scheme of regular amusement which I advocate, to aid thus fully in influencing the future movers of the country's destiny, is indeed a project to fire the imagination.

But to appeal to imagination only would be a grievous error. Some people have no imagination, or at least very, *very* little. They love to call themselves *practical* people—and with such I do not quarrel, for I have a great leaning towards the practical aspects of life myself. And I confess I sympathize with the impulse, which will lead these

to cry, "What you say is all very fine, but let the shoemaker stick to his last. You have shown that amusement is educational, but there are many educational matters with which the Board is not entitled to deal. For instance, technical and professional training, and secondary and higher education. It is true you do not ask for the Board itself to take up the work, but you seek its sanction, and one never knows but that what the Board sanctions to-day it may not undertake to-morrow."

"School Boards," the dissentients will affirm, "exist for no other purpose than that of carrying out the Elementary Education Acts, and their sphere of action should therefore be limited to seeing that the children under their control get as good an elementary education as the time and resources at the teachers' disposal, and the physique of the children themselves, will allow.

To afford facilities, by lending schools rent free for the wide scheme of organized evening amusement now proposed, appears to such persons as quite foreign to the functions of School Boards.

But these cavillers can be reduced to silence and acquiescence, if we can only show them that fortnightly evenings of amusement in our schools can actually be made to forward the admitted objects of the Board's existence; that they will, in short, produce excellent results in raising the average

of attendance.[1] It is not difficult to see how this will be.

Every Sunday-school teacher knows how the benches fill up just a month or two before the annual school-treats. These Happy Evenings, I venture to think, will be a series of school-treats, and their effect on attendance, therefore, will be marked and continuous, more especially if it be distinctly understood that children who fail to make a specified number of attendances in the week will be excluded from the delights of the gatherings.

It goes without saying that the poorer and the more densely populated the district, and consequently the more miserable the homes, the greater will be the children's enjoyment of these weekly or fortnightly evenings of pleasure, and the more they will seek by regular attendance to secure the privilege of going to them.

And so even the practical may well join hands with us in our endeavour to get evenings of amusement arranged for the children. While as to the educational enthusiasts—those who, in contradistinction to the so-called practical persons I have just described, would get the Board to be for *ever* extending the field of its operations—they too

[1] The head-mistress of a large school in Marylebone stated that the average of good attendance went up 5 per cent. after the Happy Evenings were started in her school.

ought to welcome the establishment of Children's Happy Evenings, which may prove a potent means of winning recruits for recreative, evening, and manual classes, and so of helping on the great continuation school system.

Some people have appeared to doubt this—have apparently laboured under the impression that these evenings will be detrimental to the Recreative Evening Schools Association classes. I really cannot see why they should. It is true that on occasions the Recreative Classes have suffered somewhat when a Recreative Club, pure and simple, has been opened in the neighbourhood. But this, I submit, is not at all an analogous case. Our evenings of organized amusement started in connection with the Board Schools could not clash in the same way, because, in the first place, a large number of the children coming to them would be too young to be fit subjects for the Recreative Classes, and, in the next place, the promoters of the Children's Happy Evenings would consider it a point of honour—to say nothing of its being a course which regard for the children's welfare would dictate—to urge the elder boys and girls who had passed out of school, but, thanks to these evenings, not out of the range of school influences, to avail themselves freely of the invaluable opportunities for continuing their education which the Recreative Evening Schools Association classes afford.

I should imagine, myself, that any of us who have successfully started evenings of organized amusement for children in a given school would consider it rather a feather in his or her cap if, in consequence of this step, a demand was created later on for the establishment of Recreative Classes where before no such demand existed.

And, any way, it is no part of this plan of organized amusement to open *classes*, or to *teach* anything, unless incidentally, and as an item in a programme of amusement, so that rivalry with the Recreative Evening Schools Association is certainly not to be feared. Personally, I should object strongly to clashing with any movement already progressing under School Board auspices, more especially as I consider the multiplication of agencies for performing the same work one of the most regretable features of our modern philanthropy.

But this is rather digressing, and it will be better to come back to essentials. In short, having shown that evenings of organized amusement for our Board School children will tend to promote happiness, improve health, be a great broad channel of good influence, and a means of forwarding education by their effect on attendance at day schools and by their incidental power of winning recruits for Evening and Recreative Classes, I will now proceed to detail how these evenings can best be promoted.

II.

HOW THEY CAN BE PROMOTED.

In the first place, it will be necessary to form small working committees in the different districts to arrange the evenings for each school or group of schools. These committees should consist, if possible, of a certain number of managers, of the head-mistress of the school, and of such ladies and gentlemen residing in the locality as are willing to serve. There should also sit on each local committee at least one member of the central committee of the Children's Happy Evenings Association, to keep the branches in touch with the centre.

The work of the branch committees will resolve itself into finding helpers, drawn partly from themselves, and partly from the outside public, and arranging that on certain evenings so many of these shall attend the school, and superintend and take part in the children's play.

Of course it is not *essential* to the scheme that managers principally shall form the committee, or that the head-mistress shall sit on it; but the advantages of having the co-operation of managers and teachers are immense.

The local committees will, in the first instance, have to raise the funds necessary for printing,

postage, and other secretarial expenses, for caretaker's fee and for hire of piano. Later on, however, these last items will be supplied by grants from the central committee, which will collect funds on a large scale from the public.

But the district committees will always determine the nature of the proceedings at the Happy Evenings, and get up any extra gala entertainment for the children's parents now and again.

It is possible that, with the direction of matters left entirely in the hands of each district committee, some divergence may obtain in methods of conducting the evenings ; but, on the whole, the general ground-plan will be somewhat as follows.

Once a fortnight, at the very least—much oftener when possible—a hall or large class-room in the Board School will be thrown open, from 7.30 to 9.30, to the children of the higher standards attending the school, and to a certain number of those who have passed out of school.

For the first hour the younger children should be encouraged to run, jump, skip, and shout to their hearts' content, the helpers leading them in "Oranges and Lemons," "Here we go gathering Nuts and May," "Poor Jenny is a-weeping," and all the dear old-fashioned round games which children delight in. The elder girls should have their share of brisk movement too, only in their case it might with advantage take the form of *dancing*.

Now, sometimes there will be found to prevail strong local prejudices against dancing, to which it may be well to bow. But under these circumstances much the same kind of excuse for physical exercise can be provided, under the guileless title of "Games set to Music." The cotillon, for instance, could easily be modified into a very fascinating game; while Sir Roger de Coverley and some other nondescript country dances would pass muster with the most puritanic if only the ill-omened word "dance" were not applied to them.

I myself should prefer to see *bona-fide* dancing openly taught and encouraged—quadrilles, lancers, polkas, Highland schottisches, and even waltzes. For although it is not often that I find myself in the same camp with the Rev. Stewart Headlam—a fact which does not lessen our mutual respect for each other, I hope—yet, in his enthusiastic belief in dancing as a means of cultivating grace, conducing to health and increasing enjoyment, I am quite at one with him. Risks are talked about in connection with dancing; but there is *nothing* out of which harm *can* not come, and no more harm is to be dreaded from teaching girls to dance, than from teaching them to take a pride in themselves, and fostering taste and neatness in dress, which I should certainly be disposed to do.

The tendency to find pleasure in dancing is ineradicable. Mr. Booth, in his graphic description

of "Life and Labour in the East End," specially comments on the love of dancing which bursts out whenever it has a chance. "Let a barrel-organ strike up a waltz at any corner," he tells us, "and at once the girls who may be walking past, and the children out of the gutter, begin to foot it merrily."[1]

If you set your face against dancing, then, you don't keep girls from it; you only get clumsy prancing and rough horse-play instead of that graceful gliding in which the true poetry of motion finds embodiment.

The great thing is, while you are teaching them to dance, do not neglect to imbue them with such a sense of the superiority of graceful over vulgar dancing, and refinement over coarseness, that they will not be at all tempted to seek low-class dancing-saloons. Decorous respectable dances are, to a certain extent, within the reach of the working classes, and will be more so as trade organizations amongst women increase in number, and the Children's Happy Evenings spread all over the land.[2]

[1] Canon Maclure, speaking at the Church Congress last year, said that "in Lancashire, many" (amongst whom he numbered himself) "not only suffered, but encouraged their Sunday-school scholars to dance, and they did it on principle, in preference to playing games more likely to lead to familiarity. . . . Opportunities should be given and places provided to dance in, so that people might not be relegated to the dancing-hall."

[2] In the States they are enlightened in regard to dancing, for in

Only just recently the oldest Women's Trades Union in London—the Society of Women employed in Bookbinding—gave a Cinderella dance, to which the men of the trade were duly invited. I am certain, from my knowledge of the charming, respectable girls in that trade, that the most fastidious would have found nothing to take exception to in the dancing that went on then, and I would gladly see such gatherings indefinitely multiplied.

However, the question of dancing or no dancing must be determined by the voluntary workers who manage the evenings. It will be possible to do without dancing, just as it is possible to do without music; it is only better to have both. When the children have grown tired of active games and of dancing, the younger ones may be collected together by one of the ladies in charge, who can either play "Dumb Crambo" and "Proverbs" with them, or tell them fairy tales, stories from the "Book of Golden Deeds," or even from Homer or Shakespeare. But they must not be made to listen a moment longer than they like, or it will be as bad as lessons, and the Children's Happy Evenings will increase over-pressure rather than diminish it. Directly they want to run off to play at "Follow my

Young Girls' Homes in some of the American cities dancing goes on every night; and several times in the winter the girls are allowed to entertain their friends at dancing-parties.

Leader," or "Blind-Man's Buff," they must be allowed to do so. For our object is recreation, and nothing, as Mr. Romanes conclusively shows, that fails to engross the whole consciousness can be said to be recreative.

Lady Dilke, indeed, brought out this vital point excellently well, when, on January 21, 1890, she inaugurated the first series of the Children's Happy Evenings at Waterloo Road Board School. Addressing the assembled children, she told them how in school they had to do things they did not like, because doing those was the way to make the brain one's servant and not one's master. But nothing helped them to work so well as learning to be happy at times, and doing just whatever they liked, and that was why this scheme of amusement evenings had been devised, for allowing past and present scholars to meet and enjoy themselves in a sociable and sensible manner, without the infliction of instruction.

Lady Dilke's idea was that we ought to let the children follow their own initiative, even though our influence might imperceptibly determine what that initiative should be. Agreeing with her as I do most thoroughly, I would not wish even the elder girls to apply themselves to anything useful, if they did not find it amusing and restful. When they have had as much dancing as they want, they may be induced to engage in quiet games and

occupations which exercise, but pleasantly exercise, the intelligence as well as the muscles. For though we do not want to teach them, we do want to make them apt to learn. They can play charades and do pretty fancy-work, which, destitute of all utilitarian purpose, will yet have the effect of cultivating and satisfying their sense of beauty.

Then photographs of well-known pictures and statuary can be brought down and shown to them, and such short accounts given as their curiosity demands and their mind assimilates.

Very often, after an exhibition of this sort, the suggestion of a Saturday afternoon personally conducted visit to the National Gallery will be received with acclamation.

Then, also, little discussion societies, managed by a committee of their own number, can be got up.

Above all, there should be plenty of music, and the girls themselves should be encouraged to play and sing, while from time to time an evening of entertainment entirely arranged by the children should take place, to which parents and friends might be invited.

The exact nature of the organized amusement is perhaps of less importance to those who are old hands at amusing children, than is the question of the maintenance of order and discipline.

How is this to be ensured ?

A large number of children, in the very wildest of spirits, rushing about here, there, and everywhere, must be hard to manage at the best of times, but when they are drawn, as many of them will be, from the roughest neighbourhoods of London, intending helpers may well be excused for feeling slightly nervous. Yet the helpers must prove themselves equal to the task of keeping at least so much order as is involved in exacting prompt obedience to directions. For I think we shall all agree that, however gladly we would welcome the assistance of the teachers, we must not *count* upon it. It would be scarcely fair to expect them to give up their much-needed leisure.

I know that at Waterloo Road Board School, where the Children's Happy Evenings are already established, the head-mistress, Miss Austin, does herself conduct these evenings, and by so doing has enabled a beginning to be made under the most favourable conditions. But every one may not have her energy and enthusiasm, and it must be remembered that what is recreation to the children is rather hard work for adults.

I should lay it down, therefore, as a general rule, that an evening a fortnight is the very utmost we ought ever to accept from a teacher, and that we must therefore arrange for the working of the evenings on the understanding that very likely no teachers at all will be present.

Now, will the elements of disorder prove too much for such helpers as we are likely to secure?

This is a question which experience can answer, and so here I fall back upon the experience of my friend Miss Carmichael, who for the last few years has conducted evenings of amusement in Canon Barker's Church School, Marylebone. The children she deals with are drawn from both the voluntary and the Board Schools, and include many girls of fifteen or sixteen in dressmaking businesses and the like.

Miss Carmichael, working single-handed, with the intermittent assistance of friends, has managed to exercise perfect control over some sixty or seventy of these girls. I don't maintain that the discipline is as thorough as at Waterloo Road Board School, but it is quite sufficient for a Children's Happy Evening. Order is very much, of course, an affair of the workers individuality. Some people are born to dominate others without effort and without parade, and it will be expedient to pick out such persons from any group of associated workers and distribute them well over the evenings, pairing them off with that other type of worker, who is admirable at interesting children, but who is not in the least able to control them, or at any rate is not fond of trying to do so. To judiciously apportion the workers to the work will

be half the business of the organizing district committees.[1]

It may be said that I am presupposing in this remark a large and varied supply of workers from which to make a selection.

This is certainly so; but I do not think I am over-sanguine.

In the first place, there are the numerous committees of managers throughout London. Then there are the friends of the managers. Besides this, the committees of the Charity Organization Society are available and likely sources from

[1] One way of maintaining order is to avoid all occasions of subverting order. An unsystematic distribution of sweets or toys, for instance, is apt to throw the whole assembly into riotous confusion, more especially if it seems doubtful whether the supply is adequate. If buns or oranges are given for distribution—and the practice is not one to be encouraged—the persons distributing them should, at the close of the evening, take up their position at the door or in a narrow passage, and the children should be bidden to march past them on leaving, and receive their share in turn. When the children are many and the helpers few, no games should be started which employ a small minority of the children yet attract them all. "Fox and Geese," "Here we go gathering Nuts and May," and the various round games are best under those circumstances. A skipping competition which lasted an hour would only involve fourteen or fifteen children, and would be sure to provoke clamour amongst the crowd of would-be competitors. But skipping, conducted on the principle of letting each child run in, jump once, and run out again, and then, when all had done this, giving each child two turns of the rope, and then three, and so on, can amuse some fifty children or more simultaneously, and is to be preferred.

Again, as the Rev. A. W. Jephson pointed out, the toys provided for the children should be of a kind which admit of general rather than individual application.

which to draw workers. Then, by no means *least*, though I have put them last, come the workers supplied from the ranks of past scholars, as well as those taken from the shop-assistant and the working classes.

Many a young woman engaged in industry, or serving behind a counter, will feel pleasure in becoming an associated worker with ladies of slightly higher social standing than herself, so familiarizing herself with habits and ways of thought which are new to her.

And, speaking from my own experience, I should say the pleasure would be mutual; for in the mixture of classes, the advantage is not always on the side of the class reputed the humbler.

Then there is yet one other source from which, I think, workers can be obtained, and that is from the section of (so-called) useless people.

In a sense it may be true that nothing and nobody in creation can be deemed altogether useless, but when one speaks relatively and not absolutely, it is certain that there are a great many beings in the world who must be regarded as more useless than their fellows. They serve some end, but none of a very high order, and their disappearance from the living world would affect but a limited area of human feeling.

The people I have in my mind are single women, living at home in modest households

where means are small and duties few. They form part of a home, and so to that extent, perhaps, prevent life being wholly joyless to an aged parent or a couple of sisters, also spinsters. But, apart from this, their use in the general world is trifling. They are not pretty enough, nor well dressed enough, nor sprightly nor clever enough, to be an acquisition at social gatherings; they are not sufficiently wealthy or influential to be courted by time-servers and subscription-hunters. They do not sing, they do not play, so they are not in request at concerts for the poor, or choir-practisings. They have little taste, so that at harvest and Christmas church decoratings they are asked only to do wreathing, and fetch and carry for their more gifted friends. Altogether they go through life thinking little of themselves, and being even less thought of by their neighbours.

To such people it would be opening up a realm of supreme happiness if one could say to them, "Here is a field of usefulness where you will be every whit as good as any one else. Talents are not needed; wealth, station, and beauty are all alike unnecessary. What is wanted is a readiness to give up an occasional evening once a week or fortnight, and with cheerful sympathy to superintend and assist in the play of some of the poor children in our Board Schools."

Anybody of gentle manners and kindly feeling can be a power for good by simply taking part in this work. Those who have not the physique themselves to lead the children's noisier games, can at least be present as an element of order, while those who can energetically enter into a spirited game of "romps" will be simply invaluable.

It will be found, too, that there are plenty of people who, once made to feel confidence in themselves, once relieved from the depressing sense of their own uselessness, will develop a host of unsuspected qualities, all making them of incalculable service to a Children's Happy Evenings movement.

In fact, the change effected in them by an appropriate opportunity for usefulness is comparable only to that which a scientific discovery sometimes effects with regard to the waste products of a manufacturing industry, whereby this waste product actually comes to serve as the chief constituent in some manufacture more important than that of which it was the refuse.

Really, from the point of view of this particular class of helpers, our scheme of organized evening amusement for school-children ought to be described further as a scheme for the utilization of some of our social waste products.

But this, of course, is an incidental advantage, and I am not going into all the incidental advan-

tages which will accrue from the Children's Happy Evenings.

One or two alone must detain me now. First and foremost, I place the advancement of thrift.

An increase in the number of school-banks, and a gradual formation of juvenile benefit societies, are among the results I confidently anticipate. For, according to Miss Agnes Lambert, half an hour only is required to take sixty children through the weekly exercise of a school-bank, and certainly some of the helpers at the Children's Happy Evenings would be willing thus to utilize thirty minutes out of the regulation one hundred and twenty, and to assume the responsibility of receiving and entering the deposits.

As to juvenile benefit societies, I think they might well be started among children as young as ten and eleven, and in the case of girls should decidedly include a marriage benefit—not as an encouragement to early marriage, but with a view to checking it, by offering some slight inducement to girls to defer their marriage for the sake of the more than proportionately increased monetary benefit they would then draw from their society.

To go into the working details of this scheme would carry me far afield, and it will be more to the purpose if, by way of conclusion, I now supply a few details as to the estimated cost of fortnightly

Happy Evenings, given in schools lent rent free, and without charge for gas.

The outside yearly expense under these circumstances will be £12, and this will include the hire of a piano—an item which in itself constitutes more than half the total expense—the payment of caretaker's fee, printing, postage, and a margin for such casualities as broken windows, etc.

	£	*s.*	*d.*
Caretaker's fee	2	12	0
Hire of piano	7	0	0
Postage	1	0	0
Printing of tickets	0	5	0
Breakages and contingencies	1	3	0
Total	£12	0	0

Nothing could well be more gratifying than the way in which the public has thrown itself, heart and soul, into the movement for establishing evenings of amusement for the children in our Board Schools. The School Board itself has afforded the Children's Happy Evenings Association[1] the most cordial assistance, conceding it the use of the schools, with gas, rent free. Private individuals have come forward, like Mr. Raphael, L.C.C., and

[1] The Hon. Sec. of this Association is Miss Edith Heather-Bigg, 38, Harley Street, W.

Mrs. A. Jephson, with gifts of pianos; or like Mr. Payn, Mr. Fletcher Moulton, Mrs. Guiterman, and others, with gifts of magic-lanterns, tennis-balls, toys, books, and games. Personal service, too, has been freely tendered, so that it is scarcely astonishing that the movement has spread with considerable rapidity.

It was on January 21, 1890, that Lady Dilke, supported by Sir John Puleston, M.P., and the Rev. A. W. Jephson, M.A., M.L.S.B., inaugurated the first series of these Happy Evenings in Waterloo Road Board School, where they have been held on alternate Tuesdays ever since. On February 10, the Hon. Mrs. Francis Jeune, supported by Sir James Carmichael, Bart., and Mr. Herbert Raphael, L.C.C., inaugurated a similar series for the girls in Stanhope Street, Marylebone; while on March 10, Lady George Hamilton, supported by the Rev. Osborne Jay, did the same kindly office for the scholars attending Nichol Street School, Shoreditch. The Countess of Iddesleigh, supported by the Hon. Mrs. Jeune and the Rev. T. Turner, next opened evenings for the boys of Stanhope Street School; while in the same month, Lady Dilke, ably seconded by Mr. C. A. Whitmore, M.P., and the Rev. Prebendary Eyton, started them at Cook's Ground, Chelsea. Park Walk Board School was, in April, similarly benefited, Lady Edmond Fitzmaurice on this occasion performing the in-

augural ceremony. Then, on May 12, the Marchioness of Tweeddale and her sister, the Hon. Mrs. Jeune, started the Detmold Road Board School series in Clapton; and on May 20, Countess Cadogan (the President of the Chelsea Branch of the Children's Happy Evenings Association, supported by its two Vice-Presidents, Lady Dilke and Mr. Whitmore) opened the evenings in Queen's Gardens School, Brompton.

Thus, in the short period of four months, not less than eight series of these evenings, each with its staff of workers, have been successfully organized in six districts in London; while, even as this goes to press, arrangements are being made for them in Kensal Town, Old Hampstead, St. Pancras, Battersea, etc.

The evenings in the different districts present slightly varying features. For instance, in Chelsea, Clapton, and Brompton, boys and girls are entertained together, but in Marylebone and Shoreditch separately, while in Lambeth girls only are catered for. In some places, the "Quiet Room," where the elder children can sit and read, listen to fairy tales, play draughts and dominoes, or join in conversational and quiet games, is a principal item in the evening's programme; in others, which are possessed of suitable playgrounds, the amusements during the warm weather are conducted in the open air. But, despite all

superficial differences, the essential principle is everywhere maintained, that the children should be taught to develop their own resources, and to take an active part in providing their own amusement.

MECHANICS

BY

W. H. GRIEVE, P.S.A.

MECHANICS.

THE term "Mechanics," as defined in the Fourth Schedule (Specific Subject 3 A) of the New Code, is a somewhat misleading one. "Elementary Natural Philosophy" would perhaps be the more appropriate name, for under it are included Chemistry, Heat, Electricity, Hydrostatics, as well as those parts of Mechanics which deal with the simple mechanical powers.

For convenience, the whole subject is divided into three separate stages or courses: the *first stage* dealing with matter, its mechanical properties, the various measures of length, of time, of space, and of velocity; the *second stage* considers matter in motion, in which the terms force, inertia, momentum, work, energy, are introduced—it deals with the various forces that regulate the motions of the heavenly bodies, and lastly, it explains many phenomena by referring them to the inertia of matter; the *third stage* is the practical application of the science, for in it the uses of the lever, pulley, screw, inclined plane, are dealt

with, the course concluding with a chapter on liquid pressure and the parallelogram of forces.

For the guidance of the teacher a syllabus of instruction for each year's course is drawn up, which enables him to see at a glance the work that has to be done. In Lesson I., matter and some of its properties are introduced. For instance, to prove that matter is porous, we take a piece of Malacca cane which has been fitted into a boxwood cup, place the same over the open end of a glass receiver which stands upon the plate of an air-pump, and then exhaust the air from within. If now mercury be poured into the cup, it will be observed to fall from the end of the cane within the receiver in the form of fine rain, the drops having been forced through the pores by the pressure of the air downwards. Some years ago, an experiment was tried in Florence to ascertain if water were compressible. A hollow globe made from gold was filled with water and then sealed up firmly. Great pressure was exerted upon it, to see if the water within could be compressed, with the result that the outside of the globe was coated with fine dew, thus showing that the water within had been forced through the pores of the gold. Here we call attention to the pores of the body, and remark how necessary it is for health that the skin should be kept clean, emphasizing at the same time that the neglect of the same often leads to

the outbreak of fevers. Again, the property of elasticity is illustrated by the bending of a piece of whalebone, or by throwing a glass alley upon a piece of polished marble besmeared with ink, when in each case the original forms of these substances are regained by the property of elasticity which they are known to possess. With this property we connect the use of the spring-balance, the spring-mattress, and the fitting of carriages, perambulators, chairs, and couches, with springs. Compressibility, another property which matter possesses, is shown by means of a brass syringe in which a leathern piston works. At the end of the tube is a small cavity into which a piece of tinder is inserted. The tube being supposed to be full of air, the piston is suddenly pushed inwards; the air thus compressed becomes so hot that the tinder is ignited. This experiment not only shows the compressibility of gases, but also the great heat produced by pressure. Sometimes, however, we employ a child's pop-gun, and ask him to consider why one cork flies out when the other is pushed in. As an application of this property we mention the pneumatic tube, through which parcels are sent from one end of London to the other by means of compressed air. Further, that all matter has weight, is usually demonstrated by taking a glass globe from which the air can be extracted—by weighing the globe first when it is empty and

afterwards when the air has been allowed to re-enter, the difference between the two weights being due to the presence of the air within the globe.

We next proceed to the study of the three forms which matter assumes, and to consider such properties as will enable us to distinguish the one from the other two.

First, take the *solid.* We observe that, unless force or pressure is applied, solids always occupy the same amount of space and retain the same shape ; not so with the *liquid.* Liquids have no shape of their own, but simply take the shape of the vessel which may contain them. To illustrate this, we pour water from one vessel into another of different shape, and call attention to the change of form each time it is done. But does it take up more room in the one vessel than it did in the other? We think not. From these observations we conclude that while liquids may change their form, they do not occupy more nor less space by being transferred from one vessel to another.

The gaseous state of matter is still more clearly defined. Here the molecules appear to be in a continual state of motion, each one trying to push the other further and further away. For this reason gases have no shape of their own, nor are they confined to any particular size. This property, which all gases possess, is termed *expansibility.*

We often illustrate it by placing a bladder partly filled with air, whose neck has been tightly tied, within a tall glass receiver which stands upon the plate of an air-pump. As the air is withdrawn from the receiver, the bladder is observed to fill out, thus showing that the tendency of the air within the bladder is to occupy a larger amount of space when the pressure of the air upon its external surface has been taken away. On the other hand, when the air is readmitted into the receiver, the bladder speedily collapses, thus showing the great *compressibility* of air.

The word *fluid* is next considered, it being derived from a Latin word signifying "I flow." Hence gases as well as liquids may be included under the general term *fluid*, since both liquid and gas are known to flow.

For a class experiment we take two Wooff's bottles, which contain zinc and marble respectively; into the former we pour dilute sulphuric acid, into the latter hydrochloric acid.

Now what takes place? From the bottle containing the zinc and sulphuric acid, hydrogen flows *upward*. From the second bottle, carbonic acid gas flows *downwards*.

Here, then, we have instances of two gases being made *to flow;* hence the reason why they are included under the general heading of *fluid*.

We now come to the structure of solids, more

particularly to that class known as crystals. Perhaps throughout the whole range of chemistry no more interesting spectacle can be witnessed than the crystallization of solids. Who has not noticed the beautiful forms which water presents when ornamenting the window-pane on a winter's morning? Does this happen by chance? No. Nature has provided that when certain substances pass slowly from the liquid into the *solid* state, their molecules shall not become a confused mass, but that they shall take up a definite shape and arrange themselves in a regular order. Some are seen to take up the form of a cube, as, for example, salt; while others prefer the shape of a pyramid, such as alum. These experiments are often tried by the boys themselves with remarkable success.

The various methods of hardening solids are alluded to, the process of alloying is described, and the advantages in so doing are dwelt upon as examples. We might mention the introduction of carbon in the manufacture of Bessemer steel; the hardening of our coins by the addition of a second metal; and the tempering of workmen's tools by the rapid cooling of the steel.

Our next lesson deals with the effects of heat and cold upon solids. *First*, we say solids expand by heat and contract by cold. *Secondly*, solids are converted into liquids by the application of heat. *Thirdly*, heat lessens the force of cohesion in solids.

To demonstrate the first effect, we make use of Gravesande's ball and ring, and likewise Ferguson's pyrometer, the former illustrating *cubical* expansion, the latter *linear* expansion.

The ball referred to is of such dimensions that it passes through the ring quite easily when cold ; but if the ball be heated, it will no longer pass through by reason of its increased volume.

In Ferguson's pyrometer, a metal bar is heated by the flame proceeding from methylated spirit when burnt in a trough beneath. One end of the bar is free to press against a lever which acts as a kind of index to the scale, the other end being prevented from moving by an upright support. Now, when heat is applied, the length of the bar is increased, which is recognized by the movement of the finger along the scale. The converse is shown by means of the contraction apparatus. In this we have a strong wrought-iron bar, on one end of which the thread of a screw has been cut ; to the other end an eye is forged, to allow a cast-iron pin to pass through. The bar having been made red hot, it is placed through sockets in a strong cast-iron frame. The cast-iron pin is now put through the eye, and a nut, placed upon the thread, is screwed up tightly. As the temperature falls, the bar contracts, the force with which it does so being great enough to break the cast-iron pin. This force is enormous ; for an iron

rod with a sectional area of one square inch would exert a force equal to the weight of one ton in cooling through 9° C.

The other two effects of heat upon solids are more easily shown; for if a piece of lead be placed in an iron ladle, its condition can very quickly be changed from solid to that of liquid by the application of heat.

Likewise it can be seen that the force of cohesion is not so great in a body when it is hot as it is when the body is cold. A piece of wire will support a weight of seven pounds when cold; not so if the temperature of the wire be raised, for a weight of half that amount has been known to overcome the force of cohesion in the same wire.

One little fellow gives a very simple but striking illustration of this. He states that a potato when cold may be thrown about with impunity; if, however, it be subjected to the heat of boiling water for the period of twenty minutes, the potato will scarcely bear the prong of a fork, but will fall to pieces like a ball of flour.

Having thus seen the effects of heat upon solids, one might fairly ask whether liquids and gases are similarly affected. A few simple experiments will answer this question. A saucepan nearly full of water, when placed on the fire, indicates that water expands by heat, from the fact of the water running over long before it reaches its boiling-

point. For a class experiment we employ a flask which is closed by a cork containing a piece of glass tubing. The flask having been filled with water, heat is applied at the bottom. At once the level of the water is observed to sink. This is due to the expansion of the glass; after a while, however, we notice the water rising up the tube, higher and higher, until it eventually flows over the top of the tube. Here, then, we perceive that heat has so far affected the water within the flask that the room given to it is not sufficient; it therefore expands upwards, and makes its exit in that way.

Another effect of heat upon a liquid is to change its state to that of a vapour or gas. This requires little or no demonstration, as the vapour proceeding from the spout of a tea-kettle is so frequently seen.

In speaking of the change of a liquid into a vapour, it is of great importance to bear in mind that excessive evaporation is accompanied by great cold. A simple way of testing this is by placing a test-tube which contains a small quantity of water into a test-glass containing ether. If now a stream of air be sent through the ether by means of a pair of ordinary bellows, the ether will evaporate so quickly that the water within the test-tube will be converted into a solid mass of ice. The reason for this is clear. Heat is required to evaporate any liquid; consequently the ether, in

evaporating, absorbs or takes the heat from the water within the test-tube.

Advantage is taken of this by sailors travelling in hot climates. A porous jar, having been filled with fresh water, is surrounded by a wet stocking, and then it is hauled up into the rigging to dry. By the evaporation of the water contained in the stocking, heat is withdrawn from the water within the jar, thus rendering it icy cold for drinking purposes.

This explains why we feel cold when we come out of a bath or out of the sea. The skin being wet, heat will be taken from the body to convert the moisture into vapour. It also explains the danger attending the sleeping in damp sheets: the sheets feel cold because they withdraw from our bodies heat sufficient to change the water left in them into vapour. And, lastly, to cool the streets in summer, watering-carts go round and sprinkle the roads, whereby cold is produced through the rapid evaporation of the water upon the ground.

Again, do gases expand by heat? A bladder partly filled with air, if held in front of the fire, will soon appear full. The air within, when heated, expands; that is, its molecules try to get further apart, and in so doing completely distend the bladder.

And now let us consider of what advantage it is to a lad to know all this, and to see whether he

can turn it to any practical account when he leaves school.

First, take the expansion of solids by heat. Where can he apply his knowledge of this? Let us follow him into a wheelwright's shop, where they are about to fix a tire on to a wheel. There we observe that the tire, when cold, is too small to pass over the rim; as soon, however, as it is heated, its diameter is so much increased that it falls readily over the rim. When in its place, cold water is thrown upon it, thereby causing a rapid contraction of the metal, which has the effect of drawing the spokes and rim tightly together. Again, in laying down tramway lines and railway lines, the plate-layer has to allow for the expansion of the metals by heat. In both cases it is usual to leave a space between the ends of the rails, to allow for any alteration of length through increase of temperature. To take one case only, viz. the length of the railway from London to Edinburgh, which is about four hundred miles: the extreme variations of temperature would produce a difference in the length amounting to 1288 feet. Just try and realize what this means. If the rails formed a continuous line when first put down, the very next approach of warm weather would cause them to become curved, or they would be broken to pieces.

Further, glaziers ought to know something about

the expansion of glass by heat. If the window-pane be fitted into the frame too tightly during the winter months, it would be no very great wonder if it were to crack when exposed to the great heat of summer.

Builders, also, in placing iron-beams across from wall to wall, must leave the ends free to expand; otherwise the opposite walls would be thrown out of the perpendicular. Likewise, in roofing, the sheets of zinc and lead are so arranged that they are able to overlap each other during expansion.

In fitting up schoolrooms with hot-water pipes, allowance has to be made for the expansion of the iron piping when hot water is passing through them. This is done by making the pipes to slide one within the other, after the manner of the joints of a telescope.

Then, again, railway engineers see that iron bridges are never fixed at both ends; one end, as a rule, rests upon rollers to allow for the expansion of the bridge during the hot weather.

Watchmakers and clockmakers have to allow for expansion in the construction of the balance-wheel of a watch, and also in the pendulum of a clock; in the former case, the watchmaker employs two metals, which are soldered together to form his balance-wheel. When heated, the radius of the wheel expands; at the same time the compound strip, which forms the rim, curves inwards, which

compensates for the extension of the radius. Hence there is no deviation in the rate of the wheel.

Furnacemen should be cautioned against fitting the bars of furnaces too tightly into their places, lest while expanding they might exert sufficient force against the bridges or brickwork at the back of the furnaces to throw them down.

Then, again, the bursting of water-pipes during frosty weather might be obviated if it were more generally known that water, in cooling from 39° F. down to the freezing-point, *expands* instead of *contracts*, thus disregarding the law already stated, that liquids expand by heat and contract by cold.

Another important application of the effects of heat might be given, as it affects us all to a large extent. I refer to the subject of ventilation. The air in a room, when heated, expands and rises to the ceiling by reason of its diminished density, and is there disposed of by the opening of the top sash. Similarly, by raising the bottom sash, a fresh supply of pure air is admitted to take the place of that which has passed out. The truth of this can be tested by bringing a lighted taper or candle close to the openings at the top and bottom of the window.

In visiting one of the schools in Bethnal Green, I was forcibly reminded of the great ignorance prevailing there upon this very important subject. One of the lads that attended the school lived in

a small room with seven others in the family. The weather being exceedingly cold, and the room draughty, everything was done to prevent the air from coming in around the window-sills and elsewhere. The chimney was likewise nicely packed with old sacks, and the door carefully listed.

Before retiring to rest, to make matters worse, a clear coke fire was brought into the room and placed upon the hearth. The door was then shut, and the family retired for the night. Need I say that in the morning one of the number was found dead? No comment is here needed; it tells its own tale. Is it not advisable, think you, that children should be taught to suffer a draught to exist in their bedrooms rather than run the risk of being poisoned by the inhalation of carbonic acid gas?

We now come to the consideration of the second state in which matter presents itself, viz. to the liquid state.

Liquids are usually divided into two classes, *viscous* and *mobile,* according to their running powers; that is to say, if a liquid, in being poured from one vessel to another, runs fast, it is called *mobile;* whereas if it runs slowly, *viscous.*

One of the most important applications of the mobility of liquids is witnessed in the supply of large towns with water. The highest point in the

district having been determined, a reservoir is there erected. Water is then pumped up into the reservoir and allowed to fall. Now, provided that every tank or cistern is placed at a lower level than the reservoir itself, a supply of water can be obtained whilst the water is in the act of finding its own level. Again, attention is also directed to the various pressures liquids exert upon the different parts of a vessel which may contain them. For not only do liquids exert pressure upon the base of a vessel, but also upon its sides, and this in proportion to the depth of the part below the surface. A favourite experiment with boys, in support of the lateral pressure of liquids, is performed with the spouting-jar, which consists of a tall can, having three holes in its sides made at different depths from the surface. The can having been filled with water, the plugs are removed from the holes; three jets of water issue with different velocities, owing to the pressures of the liquid at these points varying in extent. The same truth may likewise be demonstrated by means of Barker's mill, which is simply a cylindrical barrel having four arms inserted in the side. In these arms tiny holes are drilled which allow of the water to issue horizontally. Through the barrel passes a vertical spindle, around which it can rotate freely. Water, having been poured into the barrel, emerges from the tiny holes in the four arms, thus producing a rapid rotation

of the cylinder. This is entirely due to the lateral pressure of the water upon those parts of the arms immediately opposite to the four holes. Rotating fireworks also work upon the same principle.

Again, another illustration of liquid pressure, which is of considerable importance to us, is met with in Bramah's press. In this case we have to deal with the equality of liquid pressure; by which we mean that when a liquid is shut up in a vessel and pressure is applied to it from without, the pressure is transmitted equally in all directions to all parts of the internal surface. To get a clear idea of the truth of this statement, let us take a hollow ball and prick it in several places with a fine sewing-needle. Now fill the ball with water by immersion, and place the finger or thumb over the large hole in the ball. By exerting the smallest amount of pressure by the aid of the finger and thumb, jets of water are observed to issue from these small holes with equal rapidity, thus showing that the pressure has not only been transmitted in all directions, but upon equal surfaces with the same force.

If we examine a model of the press, we observe two pistons working air-tight in two cylinders, the space between the two pistons being filled with water. Now, when pressure is applied vertically downwards to the small piston by means of a lever, the large piston is observed to move upwards

by reason of the pressure which has been transmitted to it by the water between the two pistons. The weight which can be supported upon the large piston depends upon the relation existing between the areas of the two pistons. For instance, if the large piston has an area of a hundred square inches, and the small one but two square inches, then, since a hundred contains two fifty times, the pressure exerted upwards upon the large piston will be fifty times that exerted upon the smaller piston downwards. Some idea of the value of the press may be obtained from the statement that a single press has been known to raise a weight of two thousand tons.

We now proceed to deal with the question of *upward* pressure, or, as it is often called, the *buoyancy* of a liquid.

It is well known that if a body be weighed in air and also in water, it thereby loses a part of its weight. This is shown by the Archimedean bucket and cylinder. From one of the scale-pans of an ordinary balance a hollow cylinder of brass is suspended, and below this a solid cylinder of exactly the same volume as that of the interior of the hollow cylinder; these two are then balanced by weights placed in the opposite scale-pan. Let a vessel of water be now placed below these cylinders in such a manner that the lower one may dip into it. The equilibrium of the

balance is at once disturbed. How do we account for this? Simply by supposing that the water in the vessel beneath is exerting a certain amount of upward pressure upon the base of the cylinder. The amount of this upward pressure can be ascertained by pouring water into the hollow cylinder, which will cause the beam of the scales to return to its first position of rest, at the same time the solid cylinder becomes totally immersed.

What conclusion may we draw from this? Is it not that the weight of the water poured into the hollow cylinder is a correct measure of the *buoyancy* or upward pressure of the liquid?

An anecdote is told of Archimedes which practically illustrates the accuracy of his ideas. Hiero, King of Syracuse, had a certain quantity of gold made into a crown, and, suspecting that the workman had taken some of the gold and in its place had used a certain alloy of the same weight, applied to Archimedes to solve the difficulty. Archimedes, while reflecting over this problem in his bath one morning, observed the water running over the sides, when it occurred to him that he was displacing a quantity of water equal to his own bulk; and therefore a quantity of pure gold equal in weight to the crown would displace less water than the crown, the volume of any weight of alloy being greater than that of an equal weight of gold. It is related of him that he immediately ran out into

the streets crying, "*Eureka! Eureka!*"—"I have found it! I have found it!"

From this circumstance the following principle is now known as the principle of Archimedes, viz. every solid immersed in a liquid loses a portion of its weight equal to the weight of the liquid displaced. Of course it is assumed that no part of the solid is dissolved by the liquid. Another simple and yet amusing and instructive experiment is performed by placing a new-laid egg in fresh water, in salt water, and in a mixture of the two. In the first case the egg is observed to sink to the bottom of the glass, in the second it floats upon the surface of the water, whilst in the third case the egg is observed to remain suspended in a layer of the liquid whose density is equal to that of its own. These results point to the fact that the buoyancy of a liquid depends upon its density.

Now, some one may ask, What use can a lad make of his knowledge of buoyancy? In reply, we might take the case of some milk about the purity of which we are somewhat in doubt.

By placing a lactometer in the liquid, he observes that the depth to which it sinks is not in accordance with its behaviour on some former occasion when milk of known purity was taken. He thus concludes that the liquid he is testing has not the density of pure milk, but that a second liquid of

less or of greater density has been added to it. Again, the lad may be employed in some warehouse where a number of liquids are being tested as to their strength or purity. He there finds the hydrometer to be of great service to him, which is another instrument working upon the same principle as the lactometer; viz. the denser the liquid, the more does the instrument float out of the surface; or, the lighter the liquid, the more is the instrument immersed. Further, we encourage him to go to the baths for cleanliness' sake, but surely he ought to know the reason why he is kept afloat when in the water.

Perchance the boy intends to lead a seafaring life. With his knowledge of buoyancy he can understand why an old sail is put under the keel of his ship when a leak has been discovered there. With his knowledge of buoyancy he can raise ships from the bed of a river by means of lighters moored over them at low water.

Lastly, in removing wooden piles which have been driven into the bed of a river during the construction of a bridge, it is customary to saw them off close to the water's edge during low water. A barge being floated over each one, they are filled with water and chained to the pile, the water is then pumped out and the barges allowed to rise with the flowing tide; in so doing the pile is forcibly drawn out from its place in the bed of

the river by the buoyancy or upward pressure of the water upon each barge.

This brings us to the *third* division of the first stage, viz. to the consideration of gases and their properties.

Already we have pointed out the characteristic features which distinguish a liquid from a solid; now we propose to examine more minutely the special properties of gases.

First, we notice that gases are always trying to expand. *Secondly*, that gases press equally in all directions. The first property was shown by means of the bladder partly filled with air, when placed under the receiver of an air-pump. The second, viz. that gases press equally in all directions, may be demonstrated in a variety of ways.

We might, for instance, take an ordinary glass tumbler and fill it with water, place a stout piece of cardboard over it, and then turn it carefully upside down. The water does not run out. Why is this? Because it is kept within the glass by the upward pressure of the air, this pressure being much greater than the weight of the water within the tumbler. Or we might hold the tumbler sideways when the water will still remain inside the glass, through the side pressure of the air against the cardboard.

Sometimes we appeal to a boy's senses of hearing and feeling by the aid of the hand and bladder

glass, which consists of a glass vessel open at each end, nicely ground so as to stand air-tight upon the plate of an air-pump. Across the top a piece of pig-skin is tightly stretched. Now, as long as the air is left inside the glass, nothing happens; but when we begin to take out the air, the skin gradually assumes a curved appearance, and finally bursts with a loud report. This is explained by considering the enormous pressure which the air is exerting upon the outside of the skin after the pressure upon the under side has been withdrawn. Or we might have placed the boy's hand over the open end of the glass instead of the pig-skin; very soon he realizes that there is some force keeping it down upon the glass, which is none other than the downward pressure of the air.

There is also another experiment illustrative of the pressure of the air in all directions which we perform, and in which a large number of boys take part. Two hemispheres with nicely ground edges are provided with handles by which two persons can lay hold of them. One half is screwed into the plate of an air-pump and is in communication with the interior of the pump itself; the other half, having been carefully greased, is placed in position so as to form a complete sphere. While the air is allowed to remain inside, there is no difficulty in pulling the hemispheres apart; but when the air has been removed, the pressure of the surrounding

air on the whole surface is so great that it requires a considerable force to separate them.

Now, all this may appear very amusing; yet, is there no practical application of it? Yes, we think so.

First, take the common syringe. How do we account for the water running into the barrel when the point is dipped into a vessel containing water? Simply by pointing to the *vacuum*, or empty space, which is formed by drawing up the piston, and by considering the great pressure of the air upon the surface of the water, which has the effect of driving the water in to fill up the vacuum.

Secondly, take the syphon, which is simply a bent tube with one arm longer than the other. How is it that water will rise from a vessel up into the smaller arm, flow over the bend, and out from the longer arm? The answer is—a vacuum having been created within, the air, in pressing downwards upon the surface of the water, lifts it up and over the bend, provided that the bend is within thirty-four feet of the level of the water in the vessel. In support of this statement, the following experiment will be found to be interesting. Two bottles are fitted with corks, through which pass the two ends of a syphon; water is then poured into one bottle sufficient to nearly fill it. Through the cork of the empty bottle a hole is bored, and the whole arrangement is then placed under the receiver of an air-

pump. Now, in pumping out the air from the receiver, we create a vacuum in the bottle containing the perforated cork. Observe what happens to the water in the other bottle. The small quantity of air left in it acts downwards upon the surface of the water, and has the effect of lifting the water up the pipe and thence into the empty bottle. This is what takes place in every syphon. In one way or another a vacuum is created within the pipe; this vacuum is immediately filled by water rushing in, it having been driven there by the downward pressure of the air upon the water outside.

Thirdly, the barometer. Torricelli, a pupil of Galileo, in 1643, performed a very simple experiment by taking a glass tube about thirty-six inches long, closed at one end and open at the other, and by filling the same with mercury. When he had placed his finger over the open end, he turned the tube upside down and lowered it into a cup of mercury; on removing his finger, however, the mercury fell to within a certain distance of the surface of the mercury in the cup, which, on measuring, was found to be about thirty inches.

Pascal, who desired to satisfy himself that the force which kept this column of mercury from falling was really due to the downward pressure of the air upon the surface of the mercury, repeated Torricelli's experiment in the year 1646, by ascending one of the mountains in Auvergne. There he found

that the height of the mercurial column was only twenty-seven inches. The difference between the two heights he attributed to the weight of a less quantity of air which pressed downwards upon the mercury in the cup.

To demonstrate the truth of the foregoing we employ a barometer-tube, one end of which passes into an air-pump receiver through an air-tight neck. Within the receiver is a glass basin, containing rather more mercury than will suffice to fill the tube. When the exhaustion is complete, there is, or there ought to be, no air within the tube or receiver. The tube is then gently pushed down into the mercury and the air readmitted into the receiver. Now observe what takes place. The air, on entering, exerts pressure downwards upon the surface of the mercury in the basin, which has the effect of driving the mercury higher and higher, until it reaches the point at which it would stand if the experiment were conducted with the barometer-tube alone.

There are two other pieces of apparatus usually shown by way of further illustration of atmospheric pressure, which are the common or lift-pump, and the force-pump or fire-engine.

As the working of these depend upon what has already been said about the syringe, syphon, and barometer, we pass on to consider some of the more specific properties of matter.

For instance, *malleability*, or that property which a body possesses when it can be hammered out into thin sheets. Perhaps the best illustration of this property is seen in gold-leaf, the thickness of which is often less than the three-hundred-thousandth part of an inch. Many years ago a letter was sent to England from Pittsburgh written on a sheet made from iron, one thousand sheets of which laid upon each other would only make one inch in thickness; the dimensions being eight inches by five and a half inches, and which only weighed sixty-nine grains. Since then Wales has surpassed America, Staffordshire has surpassed Wales, and Wales again surpassed Staffordshire, till at length Swansea has succeeded in making the finest and thinnest sheet of iron that has ever yet been produced, viz. ten inches by five and a half inches, or fifty-five square inches of surface, and yet only weighing twenty grains.

Again, *ductility*, or the property which a body possesses when it can be drawn out into the form of a wire, is also referred to. Among the most ductile of all metals, we may mention gold, silver, copper, platinum. Wollaston succeeded in obtaining threads of platinum whose diameter did not exceed the three-millionth part of an inch. The manufacture of glass into fine threads is an application of ductility.

We conclude the first year's course by consider-

ing the various modes of measurement as practised by mechanics. Here an opportunity is presented to us for introducing the earliest time-measurer, viz. the *sun-dial*, the first mention of which is made in the Second Book of Kings, where we read that "Isaiah the prophet cried unto the Lord: and He brought the shadow ten degrees backward, by which it had gone down in the dial of King Ahaz" (742 B.C.). Then, again, we find that, long before the Christian era, *water-clocks* were in use, the Egyptians having hit upon the happy expedient of measuring time by the flow of water; for one Ctesibius, the son of an Alexandrian barber, who lived in the year 245 B.C., employed a jar containing water, which allowed the water to escape slowly by a hole in its bottom.

Plato took the idea of the water-clocks from Egypt into Greece; he constructed one himself that played upon flutes instead of striking the hours.

The Greeks put them to good use by placing them in the courts of justice, to limit the speeches of the various lawyers.

Julius Cæsar, when he invaded the shores of our island in the year 55 B.C., is said to have found a water-clock in use among the natives, and by the help of it to have observed that the summer nights in Britain were shorter than those of Italy.

Again, Alexandria boasts of having discovered

the *hour-glass*, by means of which another method was found for measuring time. The sand or hour-glass has been greatly honoured, for, besides being borne by the bald, bent, and decrepit form of old Father Time, it has been the stock-in-trade of poets from time immemorial. Now, alas! it has dropped to the position of a prosaic egg-boiler, and is even made to ring a bell, to jog the memory of the cook.

Further, according to Asser, Alfred the Great, when a fugitive in his own country, vowed that, if he should be restored to his kingdom again, he would devote a third of his time to the services of God. This vow he afterwards fulfilled by setting apart eight hours of the day to acts of religion, eight hours to public business, and the same number to sleep, study, and refreshment.

To measure and rightly divide his time he adopted the following simple expedient. He procured as much wax as weighed seventy-two hundredweights, which he commanded to be made into six candles, each twelve inches in length, with the divisions of inches distinctly marked upon them. These, being lighted one after another regularly, burnt four hours each, at the rate of an inch for every twenty minutes. Thus the six candles lasted twenty-four hours, two monks being duly appointed to watch them carefully and act as snuffers, fingers being the instruments in use for the purpose at that time.

Now we come to something more modern, viz. to the *wheel-clock.*

The date of the introduction of wheel-clocks and their inventor is uncertain. One thing, however, is known, that clocks moved by weights and wheels were in use in the monasteries of Europe during the eleventh century.

In 1365, during the reign of Edward III., there was a *clochard*, or *bell-tower*, at Westminster. This was taken down in 1715, and "Great Tom," the predecessor of "Big Ben," was given to St. Paul's.

One of the most important discoveries in relation to the history of clocks was that of the pendulum, which Galileo, the famous astronomer, in 1582, happened to make while engaged in the cathedral, in the contemplation of the lamps which swung by chains from the roof. He observed that their oscillations, whether great or small, were performed in equal times, the truth of which important fact he tested by the beats of his own pulse. He afterwards discovered that, the shorter the pendulum, the less was the time of its vibration or beat. Now, a pendulum of $39\frac{1}{7}$ inches will oscillate once in a second in the latitude of London; but if it were taken to the equator, it would have to be shortened; or if to the poles, then it must be lengthened.

The latest and most convenient mode of measuring time is by means of the *watch.* The word "watch" is derived from the Saxon *waecca*, to

"wake;" the Swedish *vacht*, "watch" or "guard;" or the Danish *vagt*.

The first step towards watch-making was the invention of a coiled spring, as the motive power in lieu of a weight which is the source of motion in clocks.

And now let us turn to the *measurement of space*. We are all familiar with such terms as foot, yard, inch, and the like: will it not be of interest to a lad to be able to trace them back to their origin, and also to glance at the various modes which his forefathers had of measuring bodies?

Josephus, the Jewish historian, mentions the tradition that Cain, after his wanderings, built a city called Nod, and settled there; also that he was the author of weights and measures. The most ancient unit of length in Egypt under the Pharaohs was the natural or common cubit of six palms, and equal to about 18¼ English inches. Further, we learn from ancient manuscripts that the cubit was the length of a man's arm, measured from the point of the elbow to the extremity of the middle finger, it being considered as the most convenient standard unit of length.

Again, the Greek foot, which was two-thirds of the Egyptian cubit, having been introduced into Italy as a mode of measuring, it was there divided into twelve parts, or *unciæ*. It is from this Latin word we derive our English word "inch." Similarly, the

English yard is said to have been derived from the length of the arm of Henry I.

We have yet another unit which reminds us of former times, viz. the hand. Jockeys and horse-dealers speak of the horse standing so many hands high, the hand being equal to four English inches.

At the present time our standard unit of length is the yard, from which all other measures are taken. To prevent any dispute about the exact length of this measure, the Government has decreed that the measure of a yard shall be the distance between two fine lines marked upon a bronze bar, thirty-eight inches long, one inch broad, and one inch deep, at the temperature of 62° F. For the information of any who may wish to see the imperial unit, permit me to say that it is deposited in the Houses of Parliament, and correct copies of it at the Court of Exchequer, the Royal Mint, the Royal Society, and the Royal Observatory at Greenwich.

And now for a word or two about the second and third stages of our subject; for, since we have taken up so much space for the first stage, we must of necessity be brief.

In the second stage matter in motion is introduced, with the various forces that produce motion; likewise the terms *friction*, *energy*, *inertia*, *momentum*, are explained; the course concluding with the various sources from which *energy* may be derived.

As illustrations of heat being a force, we perform the following two experiments. A piece of brass is made in the form of a wedge, with a groove running along the whole length. To one end a bar of iron is attached, which terminates in a knob. The rocker—for that is its name—is then put into a fire and raised to a blood-red heat. Upon taking it out and placing it upon a leaden support, a brisk vibratory motion follows, giving rise to a musical sound; thus showing that the molecules of the brass have a greater velocity when they are hot than when they are cold.

The other experiment consists in heating a flask containing water at the bottom, when two currents are observed, viz. an upward current through the centre of the water, and a downward current by the side of the glass. These two currents are produced by the heating of the lowest layer of water; for as it gets warm, it also becomes much lighter, and being lighter than the layers above, it rises and produces an *upward* current. Then the cold layers at the top fall to take the place of those that have ascended, giving rise to the *downward* current.

Another force capable of producing motion, and which is of great interest to the student of nature, is the force of *gravitation*. By it we are able to explain the action of the sun upon the various planets which comprise the solar system; how each planet

is kept in its orbit by some well-defined law; why the waters upon the surface of our globe rise up into a heap, thus producing the tides; and likewise by it we are able to account for the falling of a stone towards the centre of the earth. The famous guinea and feather experiment of Sir Isaac Newton is here introduced to show that all bodies fall with equal rapidity in a vacuum. Thence we proceed to deal with the property of *inertia*, by which we mean the inability of a body to change its state, either from a state of motion for one of rest, or from one of rest for that of motion. A book lies upon the table. For that book to move some force must act upon it; it may be muscular force, or it may be gravity. On the other hand, a body may be in motion; for it to stop, some external force must act upon it. To illustrate our point, suppose a perfectly round ball to be set rolling along a smooth sheet of ice: we know that it will travel a very great distance before it stops; but the very fact of its stopping leads us to look about for the cause, which is not far to seek. The friction brought about by one surface passing over another has retarded the motion of the ball, and has eventually brought it to a stand-still. From this property we try to draw several practical lessons.

For example, the danger attending a person who jumps out of a railway carriage or tram-car while

in motion; which is explained with reference to the velocity the person has when his feet first touch the ground—how the lower part of his body comes to rest while the upper part continues to move forward, thus causing him to fall upon his face.

Again, the fixing of a hammer on to its shaft, or a broom to its handle, may be explained on the same lines: in both cases the shafts come to rest before the hammer and broom, which continue to move downwards, and thus fasten themselves tightly on to their shafts.

Or, we might call attention to the plan adopted by Mr. Ramsbottom for supplying locomotives with water while the train is in motion. Those who are familiar with the line between Chester and Holyhead, and also with the London and North-Western Railway, will know that a trough containing water is placed between the rails, into which a scoop can be lowered from the tender, by which means a certain mass of water being motionless in the trough is sliced off, and ere it has time to acquire the velocity of the train is made to slide up the scoop into a tank upon the tender. Further, the method pursued in Liverpool in transporting grain from one end of the warehouse to the other upon travelling bands, furnishes another application of the inertia of matter. Likewise, we refer to the plan adopted in Manchester for preventing turbid water from running into a reservoir containing

clear water; and to the way they separate the oval from the round shots at Newcastle. In all of these cases inertia plays a very important part.

We then proceed to consider *friction*, with its advantages and disadvantages. Without friction it would be impossible for us to walk along the street or to hold anything in our hands. With it we are able to climb the steepest ascent, to hold our pen, and to prevent ourselves from falling upon a slippery road. We also distinguish *rolling* from *sliding* friction, especially with reference to the use of castors on tables, chairs, and pianos; pointing out that the amount of friction brought into play when one body *rolls* over another is considerably less than if it had been made to *slide* over the same surface. By way of application, we mention the brake as applied to the tram-car, to the omnibus, the railway carriage, by which means an amount of friction can be created sufficient to destroy the motion of the vehicle.

Lastly, we consider the word *energy*, which signifies the power which a body has of doing work. For instance, take gunpowder when placed between the ball and the end of the gun: while there it possesses energy whereby it is able to change the state of the ball into one of rapid motion. Or, consider the weights of a clock when drawn up—how in their descent they serve to keep the various wheels in motion against any resistance to which

they may be exposed. Again, a watch-spring when wound up possesses energy, since in endeavouring to unwind itself, by reason of the force of elasticity, it is capable of doing work.

We have two experiments which we usually perform to illustrate this, one being with the overshot and undershot water-wheel, the other with the pile-driving machine. With the former we are able to explain *energy of gravitation*—how that water, in falling from a higher to a lower level, is capable of doing work; whereas with the latter we show that energy can be accumulated or stored up in the act of raising a weight to a great height.

We conclude the year's course by saying a word or two about centrifugal force, at the same time performing a few interesting experiments with the whirling-table. Two of them may be mentioned, as they are of general interest—the first being the governor as applied to the steam-engine; the second being an arrangement of brass hoops by which we endeavour to explain the flattening of the earth at its poles, when the igneous rocks were in a liquid condition.

And now we come to the third year's course, about which a great deal might be said. Here we consider the various mechanical powers at our disposal. Starting with the *lever*, we dwell upon the advantages to the workman who uses it for raising heavy weights, also to the two modes of weighing

by means of levers with arms of equal and also of unequal lengths. Proceeding to the *wheel and axle*, we are able to explain the advantages derived from the use of such machines as the capstan and windlass in bringing a ship alongside the wharf; also to the use of the bicycle as a machine for travelling at a high speed.

Then the various applications of the *pulley* are considered; likewise the different arrangements for reducing the power are shown, which give rise to the various orders of pulleys.

We then pass on to the use of the *inclined plane*, by which means we can raise a weight by a power considerably less than itself. As instances, we might quote the raising of casks upon drays or in warehouses, by rolling them up an incline instead of by lifting them vertically. Further, the use of the *screw* in book-binding, or in any handicraft where great pressure is required, is considered; also its connection with the inclined plane is pointed out.

We conclude the year's work by comparing the action of *blunt wedges* with sharp ones, and by considering in detail liquid pressure, more particularly its application to the hydrostatic press.

And now I wish to say a few words about the work which has been in operation under the Board during the last five years. In 1885 there were four schools taking mechanics; to-day there are

nearly one hundred, and, judging from outward appearances, that number ere long will be more than doubled.

There are, on an average, a hundred boys under instruction in each school, although we seldom present that number for examination, since, through various causes, boys in the upper standards are continually leaving.

Now and then we hear of the whereabouts of some, and the effect which scientific teaching has had upon them. Only recently I learnt from the secretary of the People's Palace, over which Sir Edmund Currie so ably presides, that during the past three years no less than three hundred free scholarships to the technical schools have been gained by boys attending the schools under the Board.

Again, we encourage the lads to make models of pieces of apparatus such as are used in the demonstrations, and although they are somewhat rude in construction, yet nevertheless they illustrate principles imbibed during the lessons. We have evidence enough that boys like this sort of work, for in some cases the making of the model has involved personal sacrifice. One case in particular comes to my notice, in which a very poor lad preferred spending his money on material rather than bread, of which he and all the members of his family stood in the most urgent need.

Further, it often enables us to develop talent which otherwise must lie dormant; seeing that one of the best models has been made by a boy who has recently failed to satisfy Her Majesty's Inspector in spelling words from a newspaper column.

In some districts the managers take great interest in our work; in one school I find a manager as regular in his attendance as the teacher of the class; in another, prizes have from time to time been offered by managers to the one who should make the best model.

It has occurred to me more than once that science-teaching should go hand-in-hand with manual training; that boys in the manual classes might be encouraged to make these models; in fact, to complete the hand-and-eye training which is now so successfully being introduced into the schools of the Board. Further, we venture to state that it is specially adapted to give preliminary knowledge of the general principles underlying many trades and handicrafts, and of the ordinary facts of everyday life; at the same time, it prepares boys to take an interest in industrial teaching. And lastly, we have satisfaction in being able to relieve the monotony and drudgery of many a dreary life—for many a bright eye attends the classes that hails from a desolate and benighted home; to such, an experimental lesson comes as a boon and a blessing.

INDEX.